FUNCTIONAL AND AESTHETIC SURGERY OF THE NOSE

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"It is commonly stated that rhinoplasty is an easy operation to perform, but a difficult one in which to achieve an outstanding result"

M. Eugene Tardy, Jr.

We wish to express our special gratitude to Prof. M. Eugene Tardy, Jr. (Chicago) and Prof. Gilbert J. Nolst Trenité (Amsterdam) for their hints, suggestions and technical knacks in the area of septorhinoplasty.
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Extracts from the following catalogues:
ENDOSCOPES AND INSTRUMENTS FOR ENT
and TELEPRESENCE, IMAGING SYSTEMS,
DOCUMENTATION – ILLUMINATION
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<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballooning</td>
<td>Expanding and deforming the angle at the dome of the alar cartilage in a saddle nose with compensatory hyperplasia of the inferior turbinates.</td>
</tr>
<tr>
<td>Columellar strut</td>
<td>Autologous cartilage graft supporting the medial crura.</td>
</tr>
<tr>
<td>Compound graft</td>
<td>Implant which is formed by combining cartilage and polydioxane for septum reconstruction.</td>
</tr>
<tr>
<td>Delivery approach</td>
<td>Luxation technique, dislocation technique.</td>
</tr>
<tr>
<td>Double break</td>
<td>Double break in the columellar profile.</td>
</tr>
<tr>
<td>Keystone area</td>
<td>Metaphor borrowed from gothic architecture. The term denotes the wedge-shaped stone at the apex of an arch.</td>
</tr>
<tr>
<td>Non-delivery approach</td>
<td>Eversion technique or transcartilaginous approach</td>
</tr>
<tr>
<td>Open roof</td>
<td>Open nasal roof following trauma or surgery.</td>
</tr>
<tr>
<td>Pollybeak</td>
<td>Shape of the nose similar to a parrot’s beak (frequently following surgery).</td>
</tr>
<tr>
<td>Shield graft</td>
<td>Piece of septal cartilage grafted like a shield and placed in front of the medial or intermediary portion of the alar cartilages.</td>
</tr>
<tr>
<td>Spreader graft</td>
<td>Cartilaginous graft placed as a “spacer” between the upper septal rim and the triangular cartilage.</td>
</tr>
<tr>
<td>Supra tip break</td>
<td>Discrete lowering of the profile cranial to the tip of the nose.</td>
</tr>
<tr>
<td>Swinging door</td>
<td>Mobilization of the cartilaginous septum during submucous septoplasty.</td>
</tr>
<tr>
<td>Tip-defining point</td>
<td>Vertex of the convex alar cartilage.</td>
</tr>
<tr>
<td>Uncapping the egg</td>
<td>Endoscopic operating technique providing access to the frontal sinus.</td>
</tr>
<tr>
<td>Vestibular skin show</td>
<td>More than 2 mm of vestibular skin are open to lateral view, which is aesthetically displeasing.</td>
</tr>
<tr>
<td>Washed out</td>
<td>Poorly defined contour line between the nasal pyramid and the facial plane.</td>
</tr>
</tbody>
</table>
1. Functional and Aesthetic Surgery of the Nose

The nose is involved in a variety of different functions, including protection against dirt and noxious substances, transport of air, and temperature control. The nose is a reflex organ and, as an integral part of the so-called “bill”, influences the sound of the voice. Both a respiratory and a sensory organ, the nose bears the peripheral organs of the sense of smell. These two functions are inseparable – both morphologically and functionally. In addition, the nose possesses special aesthetic significance as the central structural element of the face. The aesthetic features of the face are dominated by the shape of the nose and its degree of harmony with other structures. The combination of these features determines the appearance of the face.

Since atraumatic, minimally-invasive surgical techniques are available both in the area of septorhinoplasty and endoscopic microsurgery, quite a large variety of rhinogenic problems can be tackled in the same session.

This brochure aims to present the complex field of nasal surgery, placing equal emphasis on its functional and aesthetic aspects.

1.1 The Central Role of the Nasal Septum

The nose consists of several anatomical elements, which are generally regarded as mutually dependent variables. Accordingly, an operation on one element may effect changes in the overall structure of the nose, which are often not easy to control. The final outcome of surgery is thus difficult to predict, not only because of the slow scarring process but due to the multiple variables involved. Minimally invasive techniques are indicated, particularly in septorhinoplasty applications. However, the dual nature of nasal surgery must always be taken into consideration; that is, the shape and function must be evaluated jointly. Thus, a rhinoplastic operation with primarily aesthetic concerns might well include the management of functional disorders of strictly endonasal origin.
The surgeon should strive to apply the following principles:

- Minimize reductive measures
- Preferential use of closed techniques
- No use of foreign material
- Use of micro-osteotomes
- Simultaneous application of endoscopic techniques (treatment of the diseased ethmoidal area including expansion of the frontal recess or antrostomy, dorsal septum surgery, plastic surgery of the turbinate, and so-called adjunctive measures).

The primary role of the nasal septum is to link the main nasal cavity to the external region of the nose. Consequently, many nasal deformities are associated with septal complications. The septum serves as an attachment for the lateral cartilages and provides a firm connection between the anterior nose and the facial bone keystone region (metaphor borrowed from architecture), premaxilla, nasal spine, and perpendicular plate of the ethmoid bone). Moreover, the cartilaginous nasal septum is an integral part of the isthmus region and has a major influence on the basic properties of flow, e.g. direction, fashion (turbulent/laminar), and velocity. As a result, it is the major source of functional disorders of nasal ventilation.

The central role of the nasal septum is the reason such importance is placed on adequate septal surgery as a key to successful treatment in functional aesthetic nasal surgery.

In some septal disorders, treatment of just the septum may solve not only the underlying functional problem, but also significantly improve the aesthetic appearance of the nose without impairing its structural integrity. However, in other cases requiring mobilization of the lateral cartilages and pyramid, it may be more favourable to keep the cartilaginous septum virtually untouched. Often, this can be done through adjunctive endoscopic techniques.

The scoliotic nose is one condition that generally requires adequate septal correction. In addition, the septum is a significant tissue donor and, as such, an important factor in many surgical concepts.

**Fig. 1**
The central topographic arrangement of the nasal septum.
This female patient presented with nasal obstruction, septal deviation, and a mild cartilaginous scoliotic nose to the left. Moreover, the excessively long septum distorted the nose in a dorso-basal direction (tension nose).

The cartilaginous scoliotic nose was straightened by slightly lowering the nasal dorsum in a submucous septroplasty.
1.2 Nasal Obstruction as a Cardinal Symptom

The physiological mode of breathing in humans is through the nose, both during inspiration and expiration. While the main function of the nose in inhalation is the active release of water vapor from the mucosa, humidity and heat are returned to the nasal epithelium when air is exhaled through the nose.

Disturbances in nasal breathing usually lead to functional changes of the nasal mucosa followed by morphological alterations. After a hypersecretory phase, nasal dysfunction-related chronic inflammatory epithelial changes usually lead to various forms of rhinitis sicca. As a result, insufficient periciliary sol levels lead to the sensation that nasal breathing is impeded.

The time it takes mucosal disease to spread to the posterior wall of the pharyngeal cavity, trachea, and bronchi (the so-called “change of levels”) differs from one individual to the next. The rhinologist who attends to the proximal airways should also take responsibility for the lower airways. The modern principle of “one airway – one disease” must nowadays be interpreted to call for operative therapy in functional disorders of the nose and paranasal sinuses manifesting with chronic inflammatory disease, such as COPD (chronic obstructive pulmonary disease), tracheo-bronchial hyperreactivity, and bronchial asthma.

Fig. 3
The mucociliary apparatus is the main protective mechanism of the nasal epithelium and paranasal sinuses. Goblet cells and seromucous glands produce a secretory product, which is then transported to the mucosal surface, forming a two-layered film consisting of a low viscosity sol phase and a higher viscosity gel phase. The cilia beat within the sol phase to transport the gel along distinct pathways on the mucosa of the nose and paranasal sinuses toward the choana.

Fig. 4
The mucociliary apparatus under pathological conditions. The level of the periciliary sol layer is crucial for the efficiency of the ciliary beat. Both hyper- and hyposecretion negatively affect mucociliary clearance.
1.3 Diagnosis of Nasal Obstruction

The main emphasis in nasal obstruction patients is on obtaining an accurate rhinological anamnesis. Usually, obstruction is accompanied by symptoms such as hypo- and hypersecretion, hyposmia, and, facial pain, which have to be included in the history. When interviewing the patient, the attending rhinologist should address the following questions and issues:

- Does the impairment of nasal breathing occur seasonally or perennially?
- Is nasal breathing impaired all the time or only sometimes?
- Are there differences between one side and the other?
- Do nose drops provide relief?
- Are there sneezing fits in the mornings?
- Are there any signs of allergies?
- Are headaches experienced, and if so, where, when, and what is the nature of the pain (stinging, pressing, persisting for how long, increased upon bending of the head)?

Because of their role as elements in fluid mechanics, three cross-sections of the nose are functionally significant: the entrance to the nasal cavity, the isthmic cleft, and the conchal region. The isthmic cleft, located within the limen nasi, accounts for more than half of the flow resistance on either side of the nose. Hence, flow resistance can be controlled easily by effecting minor changes in the cross-sectional area.

The special shape of the isthmic region separates inspired air flow into one main flow which is directed across the floor of the nose to the choana (posterior naris), and a minor flow diverted cranially, which serves to ventilate the middle nasal meatus and the olfactory cleft (Fig. 55). Further dorsally, the conchal head region also plays a significant role in nasal flow resistance. Airflow velocity is reduced between the limen nasi and the conchal head region (the so-called “diffusor”). While passing through the middle nasal sections, the velocity of the air usually increases. Structures impeding the flow (e.g., septal deviation, septal spurs, crests, and masses) may cause turbulence and increase nasal flow resistance.

---

**Fig. 5**

The nose as an element of fluid mechanics.

- a – isthmus, b – head of the turbinate, c – posterior nasal cavity, d – choana, e – nasal orifice, i – isthmic cleft

---

**Tab. 1**

<table>
<thead>
<tr>
<th>Rhinological Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Anamnesis</td>
</tr>
<tr>
<td>• Posterior rhinoscopy</td>
</tr>
<tr>
<td>• Nasal endoscopy</td>
</tr>
<tr>
<td>• Allergy tests</td>
</tr>
<tr>
<td>(Prick, scratch)</td>
</tr>
<tr>
<td>• Nasal cytology</td>
</tr>
<tr>
<td>• IgA, IgE, IgM Immunoglobulins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rhinological Functional Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Rhinomanometry</td>
</tr>
<tr>
<td>• Olfactometry</td>
</tr>
<tr>
<td>• Methods for determination of the mucociliary clearance</td>
</tr>
</tbody>
</table>

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Rhinological diagnosis and functional diagnosis.
1.3.1 Computer-Assisted Rhinomanometry

Computer-assisted rhinomanometry is a technique used as an objective measure of subjective sensations from impaired nasal breathing. It is based on the principle of synchronous recording of the narino-choanal pressure difference (\(\Delta p\)) in units of Pa and flow (\(V\)) in units of cm\(^3\)/s.

Active anterior rhinomanometry examination with a decongestion test is by far the most common technique in clinical practice and most relevant in the diagnosis of operations involving the nose. During the past decade, the authors have successfully applied computer-assisted rhinomanometry. Originally introduced in 1990 by Vogt and colleagues, this method has subsequently developed into high-resolution rhinomanometry (HRR).

The following significant clinical information can be obtained using this method (Fig. 7):

- Is there improvement in nasal breathing upon decongestion?

If the test clearly shows contribution of the mucosa (blue), this proves that mucosal swelling is the cause of nasal obstruction. If the cumulative values of flow in both sides (R + L) after decongestion exceeds 800 cm\(^3\)/s, and if there is a pronounced difference between left and right side, septoplasty is indicated. However, all conservative methods of mucosal therapy should be exhausted first. In differential diagnosis, one should not neglect to take into consideration allergic and non-allergic rhinitis, eosinophilic rhinosinusitis, viral or bacterial infection of the nose and paranasal sinuses or hyperreactivity.

<table>
<thead>
<tr>
<th>Obstruction</th>
<th>Partial Nose</th>
<th>Entire Nose</th>
</tr>
</thead>
<tbody>
<tr>
<td>no</td>
<td>&gt; 500</td>
<td>&gt; 800</td>
</tr>
<tr>
<td>light</td>
<td>300 – 500</td>
<td>500 – 800</td>
</tr>
<tr>
<td>medium</td>
<td>180 – 300</td>
<td>300 – 500</td>
</tr>
<tr>
<td>severe</td>
<td>60 – 180</td>
<td>100 – 300</td>
</tr>
<tr>
<td>virtually blocked up</td>
<td>&lt; 60</td>
<td>&lt; 100</td>
</tr>
</tbody>
</table>

Fig. 7a
Nasal obstruction. Reference values. Evaluation in adult patients (flow at 150 Pa, in cm\(^3\)/s).

Fig. 7b
Results from computer rhinomanometric evaluation of nasal obstruction.
• $V_{150}$ (red). An increase in flow between 0-150 Pa is a safe indication of sufficient nasal breathing. The $V_{150}$ value depends mainly on the narrowest nasal cross-section.

For reference ranges indicating obstruction, please refer to Fig. 7a.

• The ratio of the larger and the smaller $V_{150}$ flows (SQ) is an objective measure of the patient’s subjective sensation of obstruction differences between sides. An SQ value > 1.5 is indicative of non-physiological differences between the sides.

• Additional evidence of flow obstructions is obtained from the percent increase in flow at pressure differences in the range of 150 – 300 Pa ($\Delta V\%$) (yellow). A flow increase of 0% – 25% is indicative of valvular stenosis, e.g. negative pressure phenomena, or floating masses, polyps, and papilloma. A range of 25% – 40% is indicative of flow obstruction in the median section of nose and septum (crests, spurs, deviations). A $\Delta V\% > 40\%$ is evidence of good flow dynamics with no clinical corollaries.

Therefore, rhinomanometry can be used to distinguish manifest stenosis (for anatomical reasons), temporary stenosis (due to mucus disease, hyperreactivity), and pseudo-stenosis. A typical example of pseudo-stenosis is the subjective report of nasal obstruction in rhinitis sicca patients with ozena and relatively wide nasal cavity, e.g. after extensive resection of the nasal conchae.

In our hands, the measured rhinomanometric values are indispensable in the determination of indications for septal or septorhinoplastic surgery. All our patients undergo rhinomanometry and olfactometry at the start of each treatment session. As exact as computer-based measurements may be, the interpretation remains a subjective exercise. Thus, to be reasonable and accurate, clinical decisions or indications for surgery must be based on the simultaneous evaluation of the results of general anamnese, nasal endoscopy, and an allergy test (if employable).

### 1.3.2 Nasal Endoscopy

Nasal endoscopy is a method to determine the topography of nasal flow obstructions. The identification of a particular obstruction site as the cause of impaired nasal breathing is a fairly accurate indication for surgery and may help the surgeon to select the method of choice from available techniques, whether it be adjunctive endoscopic septal correction, submucous septoplasty (Cottle), or septorhinoplasty.

At the same time, nasal endoscopy is used to search for signs of septal disease which are often hardly discernible. Frequently, inconspicuous findings of the lateral nasal wall indicate ethmoidal or paranasal disease, which may cause impaired nasal breathing.

By positioning the endoscope in front of the cavum or the isthmic area, the functional state of these regions and negative pressure phenomena upon normal and forced nasal breathing can be observed.
Fig. 8a
Endoscopic examination of the nasal cavity in a patient with nasal obstruction on the right side.

\( \text{ci} \) – concha inferior, \( \text{v} \) – vomeral crest.
Anterior head of the inferior concha (0° telescope, 4 mm, KARL STORZ, Tuttlingen, Germany).

Fig. 8b
Typical appearance of the vomeral crest extending from anterior-caudal to cranial-dorsal.
The endoscope was advanced in a dorsal direction in 1 cm steps.

Fig. 8c
Imaging of the narrow pass between the body of the inferior concha and a sharp spur (s) on the dorsal end of the vomeral crest.
The endoscope was advanced in a dorsal direction in 1 cm steps.
Analysis of Septal Malposition

Of the multitude of septal malpositions, only some of the more common shall be presented.

Septal rotation allows changes of the external shape to be effected. Resection of the anterior edge of the septum can be used to shorten a long nose. Cranial rotation of the tip and emphasis of the double break of the nasal tip can be achieved by bevelling the superior anterior edge.

For additional information on this subject please refer to the CD-ROM, KS 533: “Functional Aesthetic Surgery of the Nose – The Influence of the Septum on the Aesthetics of the Nasal Tip” by Thomas Hildebrandt and Hans Behrbohm.

1.4 Surgical Improvement of Nasal Breathing

1.4.1 Submucous Septoplasty

Any septal surgery must be preceded by detailed analysis of the underlying anatomical configuration, on which the therapeutic design is based.

An essential function of the cartilaginous septum is to support the anterior nasal dorsum. To prevent post-operative collapse at this site, the surgeon should be well-aware of the existing static condition. Depending on the status of the cartilage, the surgical concept must aim chiefly at the maintenance or creation of sufficient support for the nasal dorsum. However, the structural stability of the septum depends not only on the consistency of the cartilage, but also on the way the usually elastic cartilage is incorporated in the bony framework. Any twisting, even if only to a small degree, increases stiffness, whereas the formation of horizontal bends may, for example, lessen the strength of nasal dorsum support.

1.4.1.1 Principles of Septal Surgery

- The more extensive the septal malposition or tension is, the wider the mucosal tunnels are created.
- The surgery is a chondroplasty, i.e. deviated pieces of cartilage are reimplanted after straightening. Large straightened pieces are preferable over small “mosaic stones”.
- If the septal cartilage cannot be straightened, replacement plastic surgery is the only alternative. This requires the mucosal layers to be largely intact.
- Connective tissue fibers connecting the basal septum to the nasal floor should always be separated by sharp dissection.
- A large fraction of septal problems localizes to the perpendicular lamina and vomer.
- The dorsal septum is best examined with endoscopes that can also be used within mucosal tunnels.
- Crashed cartilage and bone is the preferable material for filling the posterior portions of the septum, but should not be used in the cross-hatched area of (depicted in Fig. 10, page 16).
In clinical practice, it is often relevant to know which portions of the cartilaginous septum must be conserved or reconstructed. Ideally, the entire lamina quadrangularis would safely support the nasal dorsum. However, this cannot always be ensured in real life. If the septal cartilage is sufficiently firm and stable, the cross-hatched portion of the septum in Fig. 10 constitutes the theoretical lower limit for preventing collapse of the nasal dorsum.

### 1.4.2 Endoscopic Correction of the Nasal Septum and Lamina Perpendicularis – Adjunctive Measures

In this context, adjunctive measures are surgical procedures performed in the nasal cavity and pharyngeal space which aim at the following:

- Improvement of nasal breathing; elimination of rhinogenic ventilatory disturbance of the maxillary, frontal, and sphenoid sinuses; decompression of the ethmoid bone in ethmoidal polyposis; creation of an unimpeded access for ethmoidal surgery; and revision surgery of the olfactory cleft.

Frequently, the causes of ventilation disorders of the paranasal sinuses are located in the main nasal cavity. Therefore, indications of adjunctive surgical procedures in combination with endoscopic sinus surgery should be rather broadly defined.

Proper nasal ventilation is associated with improved post-operative wound healing, epithelial repair, and follow-up by post-operatively providing the edematous mucosa with sufficient space for expansion.

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### Adjunctive Measures for Endoscopic Paranasal Sinus Surgery

<table>
<thead>
<tr>
<th>Adjunctive Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Septum nasi:</strong></td>
<td>Correction of septal deviation, spurs, crests, perpendicular plate of the ethmoid bone, supporting septal mobilization</td>
</tr>
<tr>
<td><strong>Inferior Turbinate:</strong></td>
<td>Reduction of conchal size, reduction of posterior edges</td>
</tr>
<tr>
<td><strong>Middle Turbinate:</strong></td>
<td>&quot;Trimming&quot;, partial resections</td>
</tr>
<tr>
<td><strong>Rima olfactoria:</strong></td>
<td>Improvement of ventilatory function, excision of synechiae</td>
</tr>
<tr>
<td><strong>Nasopharynx:</strong></td>
<td>Adenotomy</td>
</tr>
</tbody>
</table>

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**Fig. 10**

Schematic showing the supportive function of the septal cartilage.
Adjunctive Correction of the Septum

In cases with circumscribed crest or spur formation, the authors advocate a minimally invasive surgical technique focusing on the direct elimination of ventilatory obstructions.

Using miniaturized instruments for endonasal microsurgery, cartilage or bony structures can be selectively reduced, fashioned, and the straightened septal grafts reimplanted.

Operating Technique

A mucosal incision is made under direct vision at the level of the head of the middle turbinate using the 0° telescope (Ø 4 mm) and a size 15 lance-shaped blade. The mucosa and mucoperichondrium are then unilaterally dissected.

The Freer elevator is used to vertically dissect the septal cartilage approximately 2 mm from the attachment at the lower edge of the perpendicular plate of the ethmoid bone. In this way access to the space below the mucosa of the contralateral side is achieved. Endoscopic dissection provides safe sparing of the contralateral mucosa. Subsequently, the posterior portion of the septal cartilage and parts of the perpendicular plate are dissected with nasal scissors. The piece removed by dissection is then detensioned, thinned out or crushed, and reimplanted at the end of surgery. Fibrin sealant may be used to close the wound. However, this latter step is usually dispensable, if dissection was carried out both atraumatically and rapidly. Insertion of a silicone splint favors the healing process, preserves the shape, and prevents hemorrhage between the perichondrium and the underlying septal cartilage.
**Benefits of Adjunctive Septal Surgery:**
- Simple endoscopic procedure. It is quite easy to excavate the perichondrium from the posterior portion of the septum.
- Minimally invasive technique, aimed solely at eliminating the aerodynamic obstruction of ventilation.
- Minimal wound surfaces.
- Few post-operative complications (low risk of synechiae formation, infection, hematoma or pain).
- Virtually a concurrent standard procedure in approximately 50 percent of cases involving endoscopic ethmoidal bone and paranasal sinus surgery with identical dissection technique.
- Optimum visual control of mucosal tunnels with a truly microsurgical dissection technique.

**Fig. 12**
Surgical steps in adjunctive septal surgery.
1.4.3 Functional and Aesthetic Septorhinoplasty

It has been our experience that rarely is there a clear demarcation between function-improving and shape-corrective nasal surgery. More often than not changes made to the external shape of the nose (e.g., in patients with a tension nose, hump nose, or scoliotic nose) are accompanied with clinically significant functional corollaries. Nasal surgery aiming to improve function quickly reaches its limits when it disregards malpositions of the external nose.

Our understanding is the objective of septorhinoplasty should always be to achieve the desired improvement of shape and function with efficient and, possibly, atraumatic surgical steps involving the different structural elements of the nose. Frequently, individual surgical steps may produce concurring effects in more than one structural element. For example, the aesthetic aspect of the nasal tip can be improved by resection of the individual alar cartilage and septum, by using cartilage transplants (shield grafts), or by changing the domal angle by means of suturing techniques. The ultimate objective is to achieve a naturally shaped nose the size of which matches the face and overall patient appearance. Invariably, this aim requires that several structural elements be included in the therapeutic concept. The aesthetic outcome of surgery depends on the extent to which the root, dorsum, and tip of the nose are included in the intervention.

Pre-operative Assessment of the External Nose

The initial steps of pre-operative patient assessment include a detailed analysis of the individual anatomical situation. Aside from true deformities, the consistency of the skin and nature of the connective tissue must be taken into consideration. The examination is supplemented by palpation. By pulling down the tip of the nose the anterior septal angle can be inspected. Palpation with the wet finger allows viewing of fine structural details. Palpation of the nasal orifice provides additional information regarding the consistency of the anterior edge and the nasal spine. It not only permits septal tension to be assessed, but also the evaluation of tension manifested at the medial and lateral crura of the alar cartilages and the junction of the alar and triangular cartilages. No physical examination is complete without a protection test. By pulling up the tip of the nose, a subluxated anterior septal edge can be exposed.
**Clinical Analysis of the Nose**

The nose is an important structural element of the face, and its shape is crucial for the general appearance. A multitude of separate factors contribute to the facial features until a pleasant and harmonious overall effect is produced. Some of these shall be highlighted in the following.

The natural arrangement of the nose, eyes, and forehead is usually considered harmonious, when these structural elements are located along an imaginary, slightly curved line. This line begins at the lower edge of the eyebrows and extends along the nasal dorsum to the *tip-defining point*.

Thus, the ideal profile would start at the nasofrontal angle, extend to the *tip-defining point* and, beyond that, via a *double break* around the columella, finally join the nasolabial angle. There should be pronounced *nasal tip definition*. In women, a slight indentation of the supratip region, the so-called *supratip break*, is also desirable.

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**Pre-operative and Post-operative Status**

![Pre-operative Status](image1)

![Post-operative Status](image2)

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*Fig. 13*  
Face with harmonious proportions and an ideal profile. Note the very slight asymmetry of the nasal pyramid which was due to posttraumatic dislocation of the right nasal process and subsequently corrected by septorhinoplasty.
Figs. 14
Functional tension nose.

a, c The line extending from the eyebrow to the tip-defining point is clearly asymmetrical due to a slight deviation of the nose to the right with septal deviation to the same side. Slight facial asymmetry due to hypoplasia of the left lower ramus of the mandible.

b, d Modifying the angle between the tip and supratip regions can bring about a clear improvement in the profile. In combination with straightening of the angulatory deformity, this measure clearly improves the overall appearance.

Fig. 15
The angle between the tip and supratip regions is important for the aesthetic appearance of the nose; particular attention should be paid to this region during functional aesthetic surgery. In patients with functional tension noses, the anterior septal angle (b 1) is located above the tip-defining point (a), (depicted in Fig. 14).

By shortening the anterior septum, either basally or dorsally, the anterior septal angle (b 2) is moved below the level of the tip-defining point. This small change, often no more than 1 mm – 2 mm, can dramatically change the angle between the tip-defining point and the anterior septal angle. This is also the site where the slight supratip break, often desired in women, is shaped.
Fig. 16
Hump nose/long nose, functional tension nose.

a, c Manifestation of a vestibular skin show, i.e. long crura medial of the alar cartilages under tension to the left and an excessively long septum exposing approximately 2 mm of the nasal vestibule. Aesthetically, this situation is unsatisfactory.

b Improvement of the line of the nasal wings mainly by reducing the infratip triangle. The desirable shape of a "seagull in-flight" was attained.

d Correction of the profile by hump reduction, tip rotation, shortening of the nose, and modification of the angle between the nasal wing and columella.

Several individual modifications join together to produce an emphasizing effect, sometimes called the "sparkling eyes".

Fig. 17
The white line depicts the ideal curvature of the nasal wings that has been compared to a seagull in flight. Cranial rotation of the tip was attained by shortening and bevelling the anterior septal edge (red). Detensioning of the crura of the medial alar cartilages was achieved by shortening the foot plates (depicted in Fig. 16).
Fig. 18

a, c, e  Hump nose/long nose with droopy tip, functional tension nose.

b, d, f  Result of surgery with cranial rotation of the nasal tip and shortening of the nose. The objective of nasal hump reduction was achieved while aiming at preserving the position of the nasal dorsum at a high level.
Mineral Alterations of the Shape of the Nose and Their Overall Effect on the Face.

Pre-operative and Post-operative Status

Fig. 19
a, c – A small, over-projecting nose on an attractive face. The cranial edges of the alar cartilages make the tip appear bulbous. Over-projection of the nasal tip, poorly defined nasolabial angle.

b, d – Slight narrowing of the nasal tip leads to a harmonious line between the eyebrows and the tip-defining points emphasizing the very expressive eyes.
Fig. 20

a, c – Aesthetically less than pleasing widening of the medial nasal dorsum with a “washed out” phenomenon. The nose is not sharply delineated from the facial plane. Tip over-projection and poorly defined nasolabial angle.

b, d – Narrowing of the nose, correction of the over-projection and nasolabial angle.
Minimal Alterations of the Shape of the Nose and Their Overall Effect on the Face.

Pre-operative and Post-operative Status

Fig. 21
Tension nose with over-projected nasal tip.

- Light reflections emphasize the angular appearance of the nasal tip region due to thin skin and relatively thick cartilage.
- Lowering of the nasal dorsum, shortening of the nose, and reduction in the tip projection.
- Reduction of the nasal tip cartilage with a diamond burr softens the superficial structure and improves tip definition.
Fig. 22  
This patient’s long nose profile was improved by cranially rotating the tip and reducing the projection. The nasal dorsum situated at a high level was preserved and now fits harmoniously in the profile.

Fig. 23  
a – Hump nose/long nose with septal deviation and partial dislocation to the left.  
b – The profile was enhanced by shortening the nose, improving tip projection, and slightly rotating the tip. As shown in Fig. 22, the profile was considerably improved without touching the nasal dorsum insertion at a high level.
Recontouring the Nasal Profile by Resection

**Pre-operative and Post-operative Status**

Fig. 24a, b
Patient with a long nose and slight pollybeak. Post-operatively the patient shows improved tip definition combined with a double break in the profile.

Fig. 25a, b
Reducing the cartilaginous dorsum of this pronounced tension nose called for detachment of the lateral cartilage from the septum and required the upper edge of the septum and the triangular cartilage to be treated separately. In this case an external approach was used.
Pre-operative and Post-operative Status

Fig. 26a
Saddle nose with *pollybeak* after previous surgery. Bulbous nasal tip due to over-correction of the nasal pyramid.

Fig. 26b
This profile was recontoured by *augmentation*, i.e. the nasal dorsum was augmented with a bone chip in revision surgery followed by shortening of the cephalic rim of the alar cartilage, interdomal suture, and placement of a shield graft. Improved *tip definition*, creation of a double break and supratip break.

Fig. 27a
Post-traumatic scoliotic nose. Pantomimists may consider a nose deformity to be very significant, since pantomimic expressiveness can be altered by changing the facial harmony and symmetry.

Fig. 27b
The post-operative result following correction of an angular deformity was assessed to be beneficial to the artistic expressiveness of the face.
Patient Interview and Consultation

Prior to any operation, a surgical concept should be developed and discussed with the patient. Pre-operative photographs may be used to unequivocally explain the intended alterations and answer any remaining questions. The use of computer programs to illustrate the intended post-operative result is quite popular, especially with those patients, who have difficulties envisioning the overall effect of their “new nose.” Therefore, it may be helpful to generate an image of the “virtual nose,” especially for patients undergoing rhinoplasty with the aim of altering their nose type.

However, one must realize that these images cannot be used to evaluate the surgical outcome, but only serve for an illustrative purpose. The aim of the pre-operative interview between surgeon and patient is to jointly define the surgical objective. While conveying an understanding of the planned intervention to the patient, the surgeon should, as a rule, also explain its limitations and risks. The interview before any septorhinoplasty should be conducted in a calm and undisturbed atmosphere.

Fig. 28a
Pre-operative findings.

Fig. 28b
“Virtual” nose.

Fig. 28c
Post-operative result.
Fig. 28d–g
In this patient the desired overall effect was achieved by changing the nose type with the following interventions: shortening the infratip triangle and creating a line resembling a “seagull in-flight” (e), tip rotation, creation of a double break, change of the tip-supratip angle, and lowering of the nasal dorsum (g).
Indications

Malpositions affecting the profile and angulatory deformities are the main indications for functional aesthetic septorhinoplasty. Other indications may be governed by patients wishing to have individual features of the nose changed (e.g. reducing the width, tip rotation, change of tip projection or definition, or correction of asymmetries).

For detailed explanations of these respective terms, please refer to the CD-ROM KS 533 “Functional Aesthetic Surgery of the Nose – The Influence of the Septum on the Aesthetics of the Nasal Tip” by Thomas Hildebrandt and Hans Behrbohm.

Main Indications for Functional and Aesthetic Septorhinoplasty

<table>
<thead>
<tr>
<th>Profile Deformities</th>
<th>Angulatory Deformities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Concave variant (e.g., saddle nose)</td>
<td>• Cartilaginous scoliotic nose</td>
</tr>
<tr>
<td>• Convex variants</td>
<td>• Bony scoliotic nose</td>
</tr>
<tr>
<td>– functional tension nose</td>
<td>• Mixed variations</td>
</tr>
<tr>
<td>– hump nose/long nose</td>
<td></td>
</tr>
</tbody>
</table>

In both saddle nose and functional tension nose, the angles at the dome of the alar cartilage have changed leading to an obstruction in ventilation.

Fig. 29a
Alteration of the angle at the dome of the alar cartilage in a saddle nose with a “ballooning” phenomenon and compensatory hyperplasia of the inferior concha.

Fig. 29b
Alteration of the angle at the dome of the alar cartilage in tension noses, the angle at the dome of the alar cartilage is less than 15°.
Clinical Cases

Saddle Nose – Broad Nose

Both functional and aesthetic considerations contribute to the therapeutic concept regarding correction of the saddle nose. The obstruction of the isthmic region in the saddle nose leads to particularly severe functional defects in nasal breathing. Due to the loss of the anterior septal cartilage the nasal framework is weakened in the area of the medial dorsum. Autologous cartilage is suitable for reconstructing saddle noses. The cartilaginous material can be harvested from the auricula or the cartilaginous portion of the eight costa. Initially, the surgeon should inspect the posterior portion of the septum and perpendicular plate for residual cartilage and bone fragments, which are preferable for reconstruction of the septum in replacement plastic surgery. This material may be used to fashion a compound graft by placing PDS film under the pieces to serve as a brace and fixing the pieces with mattress sutures. The resulting neoseptum is quite sturdy. The use of Tutoplast® Bank cartilage is another suitable option.

Case No. 1

This pronounced saddle nose developed after complete destruction of the septal cartilage due to an abscess resulting from corrective septal surgery in childhood. At the time, the maxillary sinuses were supraturbinally fenestrated as part of septal revision surgery. However, purulent secretion in the maxillary sinuses recurred repeatedly due to insufficient ventilation of the main nasal cavity. After reconstruction of the septum, the mucosa healed completely. Two sessions were necessary to completely correct the saddle deformity because of significant cartilage absorption. No osteotomies were performed and no plastic surgery of the nasal tip was required.


Surgical Procedure

1. Session

- Access exclusively via the hemitransfixion incision.
- Septal reconstruction with conchal grafts and remnants of the perpendicular plate of ethmoid bone.
- Implantation of grafts into the nasal dorsum after localized décollement.

2. Session

- Access via bilateral intercartilaginous incisions.
- Bilateral harvesting of tragal grafts.
- Localized décollement and nasal dorsum augmentation with conchal grafts.

Fig. 30d

The nasal dorsum was elevated by surgery.
Improved tip definition.
Case No. 2

Pre-operative Status

Fig. 31a
Female patient, 18 years of age, with high-grade septal deviation toward the left and collapsed nasal dorsum in combination with pronounced alar cartilage. Pre-operative profile.

Fig. 31b
Schematic representation of the pre-operative status illustrating the pronounced septal deviation toward the left.

Post-operative Status

Fig. 31c
The nasal dorsum was elevated by surgical means. Improved tip definition. Correction of the naso-frontal angle.

Fig. 31d
Surgical steps in septorhinoplasty. Simultaneous management of bilateral chronic sinusitis maxillaris. The profile was recontoured by supporting the nasal dorsum with a straight graft and augmentation with a thin strip of septal graft.
Pre-operative Status

![Fig. 32a](image)

The Functional Tension Nose

The tension nose is a typical example of the complex relationship between function-oriented corrective septal surgery and aesthetic rhinoplasty. The problem in this case is the pronounced tension on the nostrils and isthmus region because of the excessive length of the septum in the dorso-basal direction and, to some extent, in the caudal-cranial direction. The alar cartilage is pulled in a dorso-basal direction (under tension) causing the nostrils to assume a narrow, longitudinal-oval shape. The anterior septal angle may be visualized by pulling the tip of the nose down. In tension noses, the anterior septal angle is frequently located above the tip-defining point.

Patients with mild to moderate hump formation frequently wish to have the nasal dorsum slightly lowered and thus the profile improved, rather than opting for major surgery which changes the shape of the nose entirely. In most cases, the desired improvement of shape and aesthetic appearance can be achieved by limited resection. Limited excision of cartilage on the septal base and anterior septal edge, limited reduction of bony and cartilaginous humps, as well as osteotomies (using micro-chisels) usually suffice to minimize tension. The anatomical situation varies between individuals. Not only does the extent of hump formation vary, but also the relationship differs between the bony nasal pyramid and the cartilaginous portion of triangular cartilage and septum.

Figs. 32 – 37 show procedures employed in the treatment of various types of tension noses.

Post-operative Status

![Fig. 32b](image)

Case No. 3

In this case, nasal breathing was impeded, predominantly on the right side, due to septal deviation toward the right and manifestation of a significant tension nose. Anamnesis revealed recurring sinusitis of the left maxillary sinus. Thus, there was an indication not only for septrhinoplasty, but also for endonasal ethmoidal surgery in combination with antrostomy.

Surgical Management

- Endoscopic anterior ethmoidectomy and supraturbinal fenestration of the left maxillary sinus.
- Access by deep transfixion and intercartilaginous incisions; on the right side this was extended to the transfixion.
- Cottle septoplasty, including resection of basal and caudal strips of cartilage (eversion technique).
- Shortening of the anterior nasal spine.
- Dissection of the des M. depressor septi.
- Resection of the cranio-medial edge of the crura of the lateral alar cartilage.
- Limited subperiosial décollement and hump reduction with scalpel and rasp.
- Medial-oblique and arched-lateral osteotomies.
Case No. 4

Fig. 33 a, b
Female patient presenting with functional tension nose (hump nose/long nose), vomeral crest on the right and septal deviation toward the right. Narrow nasal dorsum, supratip region asymmetrical. The anterior septal angle projects beyond the tip-defining point. Poor tip definition; large bony hump.

Fig. 33 c, d
Surgical procedure: Eversion technique. Hump reduction, asymmetrical resection of the cranial fractions of the alar cartilages. Spreader graft on the left. Augmentation of the nasal dorsum with lightly crushed septal cartilage.

Fig. 33 e, f
Status after functional aesthetic septorhinoplasty. The nasal dorsum was lowered and straightened. Low-grade supratip break. Tip definition was improved by slight rotation. The cartilaginous portion of the nasal dorsum was widened and the asymmetry of the supratip region corrected. Bilateral endoscopic ethmoidectomy was performed in the same session to treat chronic hyperplastic ethmoidal sinusitis.
Case No. 5

Fig. 34 a, b
Young female patient with functional tension nose (predominantly cartilaginous hump). High-grade septal deviation with septal subluxation on the right. (depicted in ➔ in Fig. 34c)

Fig. 34 c, d ▲
Surgical Procedure: Luxation Technique
- Submucous septoplasty, luxation to shorten the cranial alar cartilage bilaterally.
- Hump reduction, medial oblique and lateral arched osteotomies.
- Adaptation of the triangular cartilage with two sutures.

Fig. 34 e, f ➔
Post-operative findings: slight narrowing of the nose, improved tip definition and lowering of the nasal dorsum.
Case No. 6

Surgical Procedure:
- Hump reduction, wedge-shaped shortening of the caudal edge of the septum.
- Resection of a nasal cartilaginous strip.
- Resection of the cephalic rim of the alar cartilages by means of intercartilaginous incisions.

Fig. 35
a, c, e Female patient with functional tension nose, hump nose/long nose.
b, d Surgical outcomes following tip rotation after tip rotation, and shortening of the nose.

Fig. 35 e, f Surgical effects on the nasal orifice and nasal vault.
Case No. 7

**Surgical Management**
- Submucous septum correction with shortening of the anterior septal edge.
- Shortening of the cranial lateral alar cartilages.
- Hump reduction.
- Double lateral osteotomies.

**Fig. 36**
- a – “Washed-out” phenomenon due to a wide nasal dorsum with relatively flat slopes.
- c – Pressure sore caused by patient’s spectacles, which is indicative of a broad, bony pyramid.
- b, d – Narrowing of the nasal dorsum, tip rotation.
Case No. 8

Surgical Procedure:
Open Approach
• Domal sutures and columella strut to uplift the nasal tip.
• Careful reduction of the cartilaginous-bony nasal dorsum.
• Osteotomies.
• Cephalic rim reduction of the lateral crura of the alar cartilages.

Fig. 37
a – Under-projected nasal tip in a patient with a hump nose/long nose, drooped columella.
b – Improvement of tip projection, shortening of the nose and tip rotation.

Case No. 9

Fig. 38
a, c – Bony, cartilaginous scoliotic nose with long triangular infratip. The anterior septum angle is situated above the tip-defining point.
b, d – Realignment of the malpositioned nose, narrowing of the pyramid, shortening the triangular infratip and conversion of the tip-supratip-angle along with minimal rotation to improve tip definition.
Correction of a Scoliotic Nose

Usually, scoliotic noses with only cartilaginous involvement can be corrected by surgical procedures affecting only the cartilaginous skeleton of the nose. The surgeon decides during the operation whether shortening or detensioning of the septal cartilage in the course of submucous septoplasty will be sufficient to achieve the surgical objectives. Additional procedures may be required, such as mobilization or shortening of the triangular cartilages.

Bony, cartilaginous deviations of the nose, however, always require additional osteotomies. Any asymmetry persisting after sufficient surgical mobilization of the individual structural elements may be balanced by augmentation (camouflage) with crushed septal cartilage.

Case No. 10

This female patient presented with a bony, cartilaginous scoliotic nose. Extensive synechiae between the septum and right lateral wall of the nose had formed after earlier septal surgery. Apart from nasal obstruction, the patient showed moderate symptoms of hyposmia.

Surgical Procedure: Closed Technique

- Endoscopic dissection of synechiae
- Hemitransfixion incision after complete submucous mobilization of the septum and placement of a “swinging door.” Removal of strongly deviated portions of the perpendicular plate, external realignment and reimplantation of the removed material. Suture of the nasal spine.
- Limited subperiostal décollement of the nasal dorsum via the hemitransfixion incision.
- Medial, lateral and transverse osteotomies, bilaterally.

Pre-operative and Post-operative Status

Fig. 39a

Fig. 39b
Fig. 40 a, b
Bony, cartilaginous scoliotic nose of a female patient, 32 years of age. Asymmetrical nasal tip due to hyperplasia of the cranial lateral alar cartilage on the left and extensive septal deviation with subluxation on the right; drooping nasal tip.

Surgical Procedure:
Open Approach, (Fig. 40c)

- Submucous septal correction (open approach) with shortening of the upper and anterior edge, resection of a basal and vertical strip.
- Shortening of the left triangular cartilage.
- Asymmetrical resection of the cranial alar cartilage portions.
- Hump reduction.
- Osteotomies.
- Adaptation and suture of the triangular cartilage.

Fig. 40d,e
Status after compensating the nasal deviation and enhancing tip definition.
Case No. 12 (Figs. 41a, b)
Bony, cartilaginous scoliotic nose with septal deviation on the left and extensive nasal obstruction.

Surgical Procedure: Closed Technique
- Hemitransfixion incision and creation of two bilaterally situated submucous “tunnels” that can be combined with each other.
- Resection of a vomeral crest.
- Shortening of the caudal septum by 2 mm.
- Shortening of the anterior edge of the septum by 2 mm.
- Medial and curved-lateral osteotomies.

Case No. 13 (Figs. 42a, b)
Patient with bony deformity of the nasal pyramid combined with septal deviation both due to trauma.

Surgical Procedure: Closed Technique
- Approach: intercartilaginous incision on the right, subsequently connected to the hemitransfixion.
- Septoplasty with complete submucous “tunneling” and creation of a “swinging door.” Deviated portions of the perpendicular plate and vomer were resected and realigned externally. Some of the grafted material was reimplanted. Suture of the nasal spine.
- Limited subperiostal décollement.
- Extramucous separation of triangular cartilage and septum.
- Medial-oblique and curved-lateral osteotomies.

Pre-operative and Post-operative Status

Fig. 41a  Fig. 41b

Fig. 42a  Fig. 42b
Case No. 14

This patient presented a very complex case. Trauma in early childhood had resulted in a bony, cartilaginous scoliotic nose. Aside from septal deviation, the tension nose had contributed to the impairment of nasal breathing (although manifested to a low degree only).

Aesthetic considerations called for removal of the small hump, moderate rotation of the nose tip, and narrowing of the supra-tip region.

Surgical Procedure: Eversion Technique

- Approach: intercartilaginous incision on the right, subsequently connected to the hemitransfixion.
- Cottle septoplasty, including resection of a basal strip of cartilage.
- Resection of the craniomedial edge of the lateral crura of the alar cartilage (eversion technique).
- Limited subperiosteal décollement of the nasal dorsum and hump removal with scalpel or rasp.
- Medial, lateral, and transverse osteotomies, bilaterally.
- Extramucous separation of the upper lateral cartilage from the septum.
Case No. 15
Pre-operative and Post-operative Status

Combination of a hump/long nose, with bony scoliotic nose and septal deviation.

Correction of the malpositioned axis, shortening of the nose and lowering of the nasal dorsum.
Surgical Procedure:
Luxation Technique
- Bilateral intercartilaginous incisions and hemitransfixion incision.
- Submucous septal correction.
- Hump reduction with complete mobilization and realignment of the nasal pyramid.
- Shortening of the upper and anterior septal edges.
- Shortening of the cephalic rims of the alar cartilage.
Case No. 16

Surgical Procedure:
Open Approach

- Septum replacement graft.
- Shortening of the dorsal triangular cartilage and limited lowering of the bony nasal dorsum.
- Osteotomies.
- Resection of the cephalic rims of the lateral alar cartilage crura.
- Columellar strut.

Fig. 45 a, c
Tension nose; bony, cartilaginous scoliotic nose pointing to the left, septal deviation to the left.

Fig. 45 b, d
Correction of malpositioned axis and profile. Improvement of the double break.
Case No. 17

Female patient with scoliotic nose and extensive septal deviation, both to the left. Chronic maxillary sinusitis on the left. Slight tension nose with relatively broad nasal tip.

Surgical Procedure: Eversion Technique

- Transfixion incision and complete submucous bilateral “tunneling”, resection of a basal strip.
- Placement of a “swinging door” and removal of deviated portions of the perpendicular plate, external alignment, and subsequent reimplantation.
- Endoscopic ethmoidectomy and supraturbinal maxillary sinus fenestration on the left side.
- Bilateral intercartilaginous incision and shortening of the cranial rims of the alar cartilage.
- Medial and curved-lateral osteotomies.

Fig. 46
Diagram depicting the operating steps.
Fig. 47
a – Bony, cartilaginous malposition of the nasal axis to the left.
c – Over-projection of the nasal tip with prominent anterior septal angle.
e – Nasal orifice under tension.
b – Realignment of the malpositioned nasal axis.
d – Correction of the tip-supratip angle.
e – Detensioning of the nasal orifice.
Case No. 18

Surgical Procedure: Luxation Technique

- Submucous septoplasty.
- Endoscopic rehabilitation of the paranasal sinuses by functional compartment surgery.
- Shortening of the anterior nasal spine and caudal septal edge.
- Shortening of the cranial alar cartilage.

Fig. 48 a
In this patient, the line between the eyebrow and the tip-defining point is interrupted by pronounced lateral alar cartilage. Anterior septal deviation to the right and chronic ethmoidal sinusitis are also manifest.

Fig. 48 b
The line was harmoniously readjusted by reducing the alar cartilage.

Fig. 49
Reduction of the cranial lateral alar cartilage.
Correction and Reconstruction of Post-traumatic Deformities

Case No. 19

Status of a female patient after frontobasal comminuted fracture and revision surgery of the skull base 10 years prior. At the time, the multiple fractured external tabula of the frontal sinus was not reconstructed. Ossa nasalia fracture, bilateral rupture of the maxillary frontal process, open roof.

Two-step Surgical Procedure:

I Reconstruction of the forehead relief with an implant fashioned by CAD-CAM techniques.

II Functional aesthetic septorhinoplasty.

- Hemitransfixion incision and exposure of the multiple fractured septal cartilage by complete submucosal bilateral “tunneling.”
- Transection of submucous scars, removal of deviated portions of the cartilage, external realignment, and mosaic-like septum reconstruction. Fixation with fibrin sealant.
- **Columellar strut** to lift up the nasal tip, flat **shield graft**.
- Short medial-oblique and curved-lateral osteotomies, bilaterally. The dislocated fragments of the frontal maxillary process and the nasal bone are re-elevated, closure of the open roof.
- Augmentation of the upper nasal dorsum with crushed septal cartilage.

![Fig. 50](image-url)  
Schematic drawing showing the operating steps.
Pre-operative Status
Fig. 51a–d

Post-operative Status ▼
Fig. 51e–g
Case No. 20

The indication for surgery in this patient was primarily determined by functional deficiencies. Twisting, especially of the bony septum, and bilateral chronic ethmoidal sinusitis had caused significant impairment of nasal breathing. Olfactory capability was also diminished, and the patient reported headaches in the forehead region. In addition, the patient sought removal of the hump which was caused by an open fracture of the nasal bone.

It was reasonable to perform all surgery in one session. During surgery, firm synechiae which had formed between the skin of the nasal dorsum and the bone, were discovered.

Surgical Procedure

- Endoscopic anterior ethmoidectomy, supraturbinal maxillary sinus fenestration and frontal sinus fenestration, bilaterally.
- Approach: bilateral intercartilaginous incisions, connected to the hemitransfixion incision on the right side.
- Cottle septoplasty.
- Décollement of the nasal dorsum necessitating localized sharp dissection of the skin.
- Hump removal.
- Medial-oblique and curved-lateral osteotomies.

Pre-operative and Post-operative Status
1.4.4 Repositioning Nasal Bone Fractures

In the authors’ experience it is feasible to reposition dislocated nasal bone fractures within five days of trauma. Though elevation of dislocated fragments at the earliest possible time is desirable as a rule, assessment of the malposition is often easier to perform once the swelling subsides, generally two to three days after the trauma.

Case No. 21

Recently dislocated nasal bone fracture after trauma to the middle part of the face of an eight year-old girl.

For reduction of nasal bone fractures, a specialized elevator has proven effective in the experience of the authors. The tips of the elevator’s branche are fitted to the internal shape of the nasal dome. Fragments can then be repositioned with little trauma by moving the instrument upwards without any levering action.

Fig. 53a, b
Status of 8-year-old girl after nasal bone fracture the prior day.

Fig. 53c, d
Status after repositioning and fixation with nasal plaster cast 10 days later.

Fig. 53e
Elevator for repositioning nasal bone-zygomatic arch fractures.
2. Endoscopic Diagnosis and Therapy of Respiratory Olfactory Disorders

2.1 Differential Diagnosis of Dysosmias

Olfactory defects may be classified according to various criteria. One such classification can be made on the basis of the defects in the quality versus the quantity of the olfactory function. As per this definition, anosmia constitutes a complete loss of olfactory competence, whereas the olfactory threshold is altered in hyposmia and hyperosmia. This change in the olfactory threshold may have an impact on all or only some odors. In parosmia, the sense of smell is changed only under specific physiological conditions, such as in pregnancy or during menses. Patients suffering from pseudosmia confuse the detected odors, sensing pleasant smells as unpleasant and vice versa. One typical example of this is cacosmia. In phantosmia, smells and odors are sensed by the patient which are not objectively present, hence, phantosmia must be considered a smell hallucination.

The ability to sense odors without being able to recognize them is called agnosmia. Currently, classification according to the topography of the olfactory defect is an established procedure in clinical practice. However, an exact definition is difficult, since the demarcation between epithelial and neural is incomplete.

Fig. 54
The peripheral olfactory organ in humans.
fo – fossa olfactoria,  
cg – crista galli,  
be – ethmoidal bulla,  
cm – medial concha,  
o – orbita,  
se – ethmoid bone,  
bo – olfactory bulb,  
fo – olfactory nerves,  
ro – rima olfactoria with olfactory epithelium,  
sn – septum nasi.
Topographic draft:  
(A. Mücke and H. Behrbohm)
The main causes of olfactory defects are acute and chronic inflammations in the area of the peripheral olfactory organs, followed by skull and brain trauma.

Other causes include processes where toxic or hormonal influences or tumors affect the olfactory system.

Physiological dysosmia manifests with increasing age, i.e., olfactory performance declines with age. The presbyphysical law of auditory systems also applies to the sense of smell.

In the treatment of ear, nose, and throat diseases, respiratory dysosmias possess great significance, since extensive diagnostic experience and a large spectrum of therapeutic options are available for treatment.

Epithelial dysosmia is indicative of some structural damage to the olfactory epithelium. Most often this type of disease is caused by influenza and herpes virus infections, which lead to olfactory neuritis through their neurotropic effects. Similarly, unspecific bacterial and specific viral infections are associated with an inherent high risk of causing damage to the olfactory epithelium.

Ozena, a rather rare disease in our time, may cause substantial pseudosmia. Granulomatous diseases, such as Morbus Wegener with its typical nasal findings, produce effects similar to ozena. There is apparently a close relationship between the epithelial structure and the function of the olfactory system and its hormonal control mechanisms. A surprisingly large number of hormonal diseases are associated with an extensive loss of the sense of smell.

The olfactory epithelia may be exposed to a broad range of potentially detrimental toxic substances, often from dusts or vapors. Environmental tobacco smoke (ETS) is but one of these substances posing a high risk potential. Another risk is iatrogenic damage to the olfactory sensation from the administration of specific pharmaceutical agents. The most important substance classes are listed.

| • Antibiotics | • Local anesthetics |
| • Antidiabetics | • Lipid reducer |
| • Antimycotics | • Psychopharmaceuticals |
| • Antiphlogostics | • Antithyroid drugs |
| • Antirheumatics | • Tuberculostatics |
| • Cardioactive agents | • Cytostatics |

Tab. 4
Dysosmia as a possible side effect of a number of drugs (selection).
Attending physicians should not neglect to bring these potential risk factors to the attention of their patients. In particular, the therapeutic use of antibiotics and antimycotic agents should be preceded by a critical assessment of this issue. Prior to prescribing any newly launched medication, it is always sensible to reference these products in an appropriate drug index and carefully read the product information leaflet. Nasal tumors (e.g., papilloma, osteoma, mucoceles, meningoceles, carcinoma, etc.) frequently obstruct the airways and consequently cause respiratory hyposmia or anosmia. However, the presence of olfactory defects may in many cases be early evidence of a neoplasia formation. Unfortunately, this evidence is often noticed too late or not at all. Usually, other cardinal symptoms lead to the detection of nasal tumors.

**Olfactory Neuroblastoma**

This is the most typical olfactory tumor originating from deep inside the olfactory epithelium. This tumor is malignant, aggressive, and forms metastases. The incidence curve of this tumor shows two peaks: one in the second and one in the sixth decade. Tumors in patients between 20 and 30 years of age show a stronger tendency to metastasize. The therapy of choice is radical surgery combined with irradiation. Three subtypes can be distinguished, though this distinction has no prognostic significance. One of the main factors for patient prognosis is the histological grading (type I – IV). Tumors with intracranial localization, i.e. mainly meningeomas of the olfactory sulcus, may also affect the olfactory system. Similarly, tumors of the medial and posterior sections of the frontal base may account for disorders of the olfactory system. The surgical treatment of these types of tumors necessitates a combination of ear-nose-throat procedures and neurosurgical techniques to afford optimal access to the cribrous lamina and ensure a high degree of radical functional surgery.

**Nervous Dysosmia**

The second most common cause of olfactory loss is destruction of the conduction system as a result of direct or indirect trauma. Frontal basis fracture and surgical interventions may be associated with injury of the nasal base. Much more frequent, however, are blunt skull traumata causing a contrecoup in the frontal brain area, usually as a consequence of occipitaltrauma.

Pathomorphological findings in the olfactory system following trauma include hemorrhage in the area of the rima olfactoria mucosa and near the olfactory tract. Frequently, cribrous lamina fracture is also manifest. Tearing of the olfactory nerves has also been a common finding, whereas bony splinters have been observed rarely.
Central Dysosmia

A wide body of clinical evidence suggests that olfactory disorders are concomitants of some neurological-psychiatric diseases, and as such associated with pronounced emotional changes. One of the most common findings is temporal lobe epilepsy, which is associated with an olfactory aura. Smell hallucinations are commonly unpleasant and lead to corresponding emotional effects, frequently with “deja vu” phenomena, which, in turn, elicit motoric and sensory phenomena.

The following list of psychiatric disorders only emphasizes the significance of the limbic system in the genesis of central dysosmias.

2.2 The Aerodynamics of Smell

Inhaled air is divided into two streams inside the isthmus near the lumen nasi, which correspondingly is the site where the flow slows down. The main current is directed via the nasal floor to the choana, whereas the minor flow is diverted cranially to pass behind the turbinate. The air is heated in the process and ascends cranially toward the head of the middle turbinate, which divides the ascending current of air into 1) a laterally diverted flow ventilating the nasal sinuses and 2) a flow diverted in a medial-cranial direction. The orientation of the middle turbinate is essential for ventilation of the olfactory cleft. The olfactory cleft is shaped like a wing suspended between three fixation points. For effective ventilation of the olfactory cleft, areas of overpressure and underpressure must build up at the lateral and medial lamellae of the middle turbinate, respectively. At the so-called leeward side, i.e. the medial side of the turbinate, the inhaled air is suctioned into the olfactory cleft.

The gustatory smell, which follows convection of turbinate flow, is governed by essentially the same principles. Aside from a biomechanical obstruction of the olfactory cleft, (e.g., due to the presence of polyps), hyposmia and anosmia may often be caused by malpositioned nasal conchae and the resulting aerodynamic effects.

Tab. 5
Dysosmia associated with neurological-psychiatric disorders.

- Abnormal memory of smells
  - «Deja vu»
  - «Jamais vu»
- Illusions/hallucinations
- Schizophrenia
- Alcoholism
- Senile dementia
- Depression
2.3 X-ray Anatomy of the Olfactory Cleft

Computed tomography in the coronal plane affords a complete view of the ethmoidal sinus cell system and paranasal sinuses. The peripheral olfactory organ is also visualized. From a multitude of individual images, we selected tomograms containing information about the olfactory organ.

Fig. 56
Computed tomography of the facial bone; coronal sections, thickness 5 mm.
Fig. 57a
The anterior edge of the crista galli near the cribiform plate defines the edge of the olfactory organ. **ts** – tuberculum septi, **cm** – concha media, **cg** – crista galli, **ci** – head of the lower turbinate, **ae** – anterior ethmoid.

Fig. 57b
Symmetrical depression of the fossa olfactoria bilaterally, **fo** – fossa olfactoria, **ie** – infundibulum ethmoidale, **ro** – free rima olfactoria bilaterally.

Fig. 57c
**H** – Haller’s cell, **pu** – processus uncinatus, **be** – bulla ethmoidalis, **cg** – crista galli

Fig. 57d
Flattening of the fossa olfactoria and crista galli; widening of the posterior ethmoid.

Fig. 57e
The skull base progressively flattens and broadens (os frontale); the olfactory bulb exiting from the fossa olfactoria, the boundary of the peripheral olfactory organ.

Fig. 57f
Insertion of the middle turbinates in the lateral nasal wall (processus pterygoideus). **cs** – concha superior.
Typical Findings in Patients With High-Grade Hyposmia

Fig. 58
Total obstruction of the rima olfactoria on the left side of the nose by polypoid mucosa in the anterior ethmoid, which displaces the middle turbinate in a medial direction.

Fig. 59
Isolated swelling of the rima olfactoria mucosa bilaterally.

Fig. 60
Coronal CT section of ethmoidal adenocarcinoma obstructing the nasal cavity and infiltrating into the left side of the orbita.

Fig. 61
Inverted ethmoidal papilloma on the left, infiltrating the frontal sinus, destroying the anterior skull base, and expanding into the rima olfactoria.
2.4 Endoscopic Inspection of the Olfactory Cleft

The 0° and 30° HOPKINS® rod lens telescopes are most suitable for the endoscopic inspection of the olfactory cleft.

Procedure:
Locar anesthesia is performed using a conical swab impregnated with tetracain/adrenaline for 5 min or by spraying the nose with a mucosal anaesthetic. Subsequently, the 0° telescope is carefully inserted via the nasal floor and advanced to the choana. The endoscope is pulled back somewhat and then advanced toward the middle meatus. The middle turbinate may be gently dislocated with an elevator to gain an unobstructed view of the middle meatus.

Parts of the olfactory cleft are visualized simply by placing the 0° telescope in front of the head of the middle turbinate. Medial positioning of the endoscope enhances the view. The 30° telescope is then used to inspect the entire olfactory cleft and upper turbinate extending all the way to the cribrous lamina.

Endoscopy of the rima olfactoria

Fig. 62a
(30° telescope, Ø 4 mm, KARL STORZ, Tuttlingen). View of the anterior left ethmoid and the rima olfactoria.

sn – nasal septum, ro – rima olfactoria, cm – concha media, be – bulla ethmoidalis, * neoplasia inside the rima olfactoria.

Fig. 62b
View of the rima olfactoria by advancing the 30° telescope an additional 1 cm.

Fig. 62c
View of the rima olfactoria by advancing the 30° telescope an additional 1 cm toward the olfactory rim. A polyp is located between the middle and upper turbinate, obstructing the olfactory rim.

sn – nasal septum, cm – concha media, sc – concha superior, * – polyp

Fig. 62d
More detailed view by advancing the telescope an additional 1 cm.
2.5 Respiratory Hyposmia Associated with Chronic Hyperplastic Ethmoidal Sinusitis

Three etiological pathways can be distinguished that lead to respiratory hyposmia associated with chronic hyperplastic ethmoidal sinusitis. Initially, mucosal hyperplasia of the anterior wall of the ethmoidal bulla may lead to medialization of the middle turbinate with concomitant obstruction of the olfactory cleft. Polyposis of the anterior or entire ethmoid usually leads to progressive obstruction of the olfactory cleft.

Fig. 63
Mucosal polyp descending from the anterior ethmoid through the middle meatus into the nasal cavity. The schematic shows progressive obstruction of the rima olfactoria by manifestation of ethmoidal polyposis.

Fig. 64
Extensive ethmoidal polyposis on the left with displacement of the middle turbinate in medial direction.

Fig. 65
A polyp with a broad base obstructs the middle nasal meatus.

Fig. 66
Extensive septal deviation on the right side and polyposis ethmoidalis. Compression of the middle turbinate, which is surrounded by polypoid mucosa.

Fig. 67
Polyposis of the left rima olfactoria with lateralization of the middle turbinate.
Compression of the middle turbinate initially causes the mucosa of the olfactory cleft to become hyperplastic, with eventual progression to pedunculated “cleft polyps”. However, the olfactory cleft mucosa may be the starting-point for polypous disease, independent of the manifestation of ethmoidal disease. Indeed as an integral part of the ethmoid, the middle turbinate may become inflamed. This may cause either hyperplasia of the mucosa at the head of the middle turbinate, or inflammatory alterations of the turbinate head or neck cells and ensuing obstruction of the olfactory cleft.

Fig. 69
Mucosal polyp (>). Originating from the head of the left middle turbinate.

Fig. 68
Schematic representation of the causes of respiratory hyposmia associated with chronic hyperplastic ethmoidal sinusitis.

a – Ethmoidal polyposis – medialization of the middle turbinate.
b – Edema of the rima olfactoria; edema or polyposis.
c – Hyperplasia of the mucosa of the middle turbinate.

Fig. 70
Ethmoidal inflammation spreading to the middle turbinate. Obstruction of the rima olfactoria by edematous swelling.
2.6 Respiratory Hyposmia Associated with Synechiae

The formation of synechiae is a typical and complicated problem of the olfactory cleft. Most commonly, synechiae form as a result of injury or trauma to opposing mucosal areas during surgery. The synechiae usually form by fibrin bridging of the 1–2 mm gap in the olfactory cleft.

Particularly extensive damage is caused by so-called polypectomy surgery, frequently performed without sufficient visual control. Here, the surgeon often blindly reaches inside the nose with the inherently high risk of damaging the middle turbinate. For this reason, ethmoidal and olfactory cleft surgery should only be conducted under endoscopic view.

Fig. 71
“Bridge-like” synechiae (o) between the nasal septum (sn) and the left lateral nasal wall (ln).

Fig. 72
Complete obliteration of the rima olfactoria by extensive formation of synechia between the middle turbinate and septal mucosa on the right side.

Fig. 73
Complete obliteration of the rima olfactoria on the right.

Fig. 74
Status after previous ethmoidectomy. (0° telescope, Ø 4 mm, KARL STORZ, Tuttlingen). Accumulated adhesions (o) of the concha media (cm) with the septal mucosa (sn), e – epithelialized ethmoidal cells opened by incision, sf – supraurtubinal antrostomy.
The following clinical aspects can be used to distinguish the three forms of synechiae associated with hyposmia (as the cardinal symptom) inside the olfactory cleft:

- Deep synechiae between the head and body of the turbinate and the mucosa of the nasal septum, leading to either an increase in turbulence and impaired ventilation of the olfactory cleft or to dislocation of the turbinate which impairs the aerodynamics of olfactory cleft ventilation.

- Accumulated synechiae between the middle turbinate and the septal mucosa, which are usually associated with anosmia pose a rather complex problem. Cutting or through-cutting instruments must be used in an attempt to reconstitute the olfactory cleft. Spacers made from various plastic materials can aid in preventing the reformation of synechiae.

- Synechia at a high level, e.g., between the cranial neck of the turbinate and the nasal septum, or below the cribiform plate, are often difficult to discern from the cribiform plate itself. The successful management of these synechiae requires considerable experience in endoscopic microsurgery of the paranasal sinuses.

- Loss of the middle turbinate means a loss of the main fluid mechanical element of the nose and the olfactory epithelium, depriving the surgeon of a major landmark.

From the authors’ experience, it is evident that even small synechiae can considerably affect olfactory competence. Atraumatic division is always beneficial and the authors commonly combine this procedure with “trimming the turbinate,” i.e., repositioning the middle turbinate in a median nasal axis. In the majority of cases, this correction can be confirmed by olfactometry.

**Fig. 75**
Formation of synechiae as the cause of respiratory hyposmia.

a – Deep synechia between the head or the body of the turbinate and the septum (bridge-like synechiae).

b – Extensive cicatricial obliteration of the rima olfactoria.

c – High-level synechiae between the neck of the turbinate and the septum just below the cribiform plate.

d – Loss of the middle turbinate.
2.7 Malpositions of the Middle Turbinate – Trimming Procedures

A malpositioned axis of the middle turbinate and certain anatomical variations of the ethmoid and septum may also cause hyposmia or anosmia, and, hence, thereby necessitating therapy.

Fig. 76
Post-operative status after trimming of the right middle turbinate. View of the basal lamella and the widened right frontal recess. The head of the turbinate divides and directs the ascending flow toward the paranasal sinuses and the olfactory cleft.

Fig. 77
45° telescope, Ø 4 mm, KARL STORZ, Tuttlingen. View of the anterior skull base. The shortened middle turbinate separates the frontal bone from the cribiform plate, which is located in the incisura ethmoidalis. sf – sinus frontalis, aea – a. ethmoidalis anterior, lc – lamina cribrosa.

Fig. 78
Close-up view (cp Fig. 74).

Fig. 79
Polyposis (*) between the middle turbinate (cm) and the unattached uncinate process (pu) on the left.
The advantageous pre-operative orientation of the middle turbinate was maintained post-operatively after removal of the uncinate process and dissection of the anterior ethmoid. The medial and lateral mucosal areas of the middle turbinates remained untouched.

Optimal trim of the left middle turbinate after anterior ethmoidectomy and supraturbinal antrostomy. The head of the turbinate should not extend into the fenestration and be located in the middle of the nose.

Note:
In ethmoidal surgery, the middle turbinate should be preserved as much as possible. If this is not feasible, then a shortened, but stable, fluid mechanical element should be generated rather than leaving behind an unstable, floating body. Usually, it is feasible to epithelialize the bony portion of the turbinate by wrapping the preserved mucosa.

Caudal view of the right middle turbinate in a patient after ethmoidal surgery. Unobstructed ventilation along the entire length of the olfactory cleft.
**Fig. 83**
Disruptions of the continuity of the turbinal body. Defects of the body of the middle turbinate lead to pressure equalization between the leeward and the windward side, which results in impeded ventilation of the olfactory cleft.

a – Head of the left middle turbinate, (0° telescope, Ø 4 mm).

b – Focus on the posterior fragment of the middle turbinate. In the medial aspect the body of the turbinate is missing.

**Fig. 84**
"Trimming" of the middle turbinate after lateralization due to post-operative scarring in a hyposmic patient.

a – Lateralization of the left middle turbinate

b – Medialized middle turbinate immediately after surgery, (0° telescope, Ø 4 mm).

Interestingly, an improvement in olfactory competence observed immediately after turbinal correction could be confirmed by olfactometry.

**Fig. 85**
Respiratory hyposmia as a result of turbinal malposition and anatomical variations.

a – Medialization of the middle turbinate

b – Lateralization of the middle turbinate
c – Concha bullosa
d – Tuberculum septi
e – Pneumatized ethmoid-turbinate complex.
2.8 Endoscopic Microsurgery of the Ethmoid Sinus and Olfactory Cleft in Olfactory Disorders

The prognosis for remission of respiratory hyposmia and anosmia following functional restitution of the ethmoidal cells and olfactory cleft is always uncertain. A clinical study was undertaken to assess clinical outcomes following functional restitution of persistent peripheral olfactory disorders.

Forty-six patients with extensive polyposis nasi et sinuum manifesting with hyposmia/anosmia were assessed in a retrospective study. Patients were tracked for six months to four years after post-operative wound healing. Patients were interviewed on their subjective olfactory competence, endoscopically and olfactometrically examined using the olfactory threshold and identification test according to CAIN.

Though the number of assessed patients was relatively small, the results of the prospective study confirmed the authors’ experience obtained in more than 10,000 ethmoid operations.

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<tr>
<td>Anosmia</td>
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Tab. 6
Results of objective olfactometry. 92 measurements in 46 patients. 76 x improvement – side-differential measurements, 15 x unchanged, 1 x deterioration.

All 46 patients reported an improvement in subjective olfactory capabilities following the operation. Only one patient reported deterioration on one side, which was confirmed by olfactometry. A total of 76 individual recordings (from 39 patients) showed improvement in olfactory capability while 15 olfactograms showed no change. In one case, deterioration was confirmed.

It is difficult to assess the sense of smell with olfactory testing, since patients show great individual differences in their predisposition to tests of this kind. Whereas the identification test shows poor results in patients with an untrained sense of smell or lack of interest in smell in general, smell-sensitive patients fare much better. In general, the sense of smell continues to be neglected. The analytical recognition of visual and acoustic cues is being trained and tested daily, whereas the detection of smells remains rather intuitive. This phylogenetically old sense is linked to the limbic system, which is involved in producing emotions.
Long-term memories are often primarily connected to sensations of smell. It also became rather obvious during the study that patients being assessed could not verbally describe specific smells, but rather associated them with particular intangible qualities. This has to do with the lack of clear definitions for smells in general while on the contrary there are standardized definitions for visual and acoustic cues. A color is red or green, while a sound belongs to a major or minor key: in contrast, smells are, in many cases, classified in a purely descriptive fashion, e.g., as “mint-like” or “fruity”. It was also apparent from the study that detected smells are often more readily associated with emotion than abstract definitions or identities. Typical responses in the identification test covered the entire gamut, including “this has the smell of a cheap shower gel,” while it took longer to identify lavender. Further investigations should deal with the question of whether, and to what extent, persistent disorders of the peripheral sense of smell may lead to functional disorders of the central nervous system.

Post-operative recovery of the sense of smell not only serves as an indicator for the quality of ethmoid and paranasal sinus surgery, but also for the consistency of follow-up care based on individual findings. The authors successfully used specialized spray nozzles for efficient post-operative treatment of the vulnerable mucosa with topical glucocorticoids. This allowed localized application of the drug (e.g. Flutide nasal®) to the ethmoidal mucosa under endoscopic vision.

Fig. 86a
The instrument set used by the authors for olfactory cleft surgery. Cutting and through-cutting instruments are particularly useful.

Fig. 86b
The paranasal sinus shaver system (KARL STORZ, Tuttingen) is ideally suited for use in the olfactory cleft since it allows circumscribed aspiration of polypous mucosa without producing extensive wounds. The rotating shaver blade is contained in a sheath which prevents opposing areas of mucosa from being damaged inadvertently.
Fig. 87
Post-operative mucosal edema of the right middle turbinate. Two weeks after ethmoidectomy.

Fig. 88
Post-operative findings three weeks after surgery.

Fig. 89
Same findings at four weeks.

Strict post-operative management of the mucosa with a topical glucocorticoid, instilled into the ethmoid under endoscopic control, affords rapid remission of mucosal edema.
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### Instrument Set for Functional and Aesthetic Septo-Rhinoplastic

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<td>Ala Double Hook, with octagonal handle, with 2 sharp points, strongly curved, special finish, width 2 mm, length 16.5 cm</td>
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<td></td>
</tr>
<tr>
<td>506400</td>
<td>Aufricht Nasal Retractor, width of retractor blade 8 mm, length of retractor blade 40 mm, length 16.5 cm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- **Cottle Knife Guide and Retractor:** one side with two-pronged nostril retractor, other side with flat retractor, with duct for guide of cut, length 19 cm
- **Cottle Retractor:** two prongs, sharp prong on left, blunt prong on right, width 10 mm, length 14.5 cm
- **Same:** sharp prong on right, blunt prong on left
- **Hook:** one prong, large curve, length 16.5 cm
- **Suction Raspatory:** with stylet, length 19.5 cm
- **Masing Elevator:** double-ended, graduated, sharp and blunt, length 22.5 cm
- **Freer Elevator:** double-ended, sharp and blunt, special matt finish, length 20 cm
- **McKenty Raspatory:** width 4 mm, length 14.5 cm
- **Same:** width 5 mm
- **Cottle Lower Lateral Forceps:** bayonet-shaped, with set screw, serrated tips and teeth on the inside, length 15 cm
- **Adson Dressing Forceps:** serrated, tungsten carbide inserts, length 12 cm
- **Adson Tissue Forceps:** 1 x 2 teeth, length 12 cm
- **Adson-Brown Tissue Forceps:**atraumatic, fine side grasping teeth, length 12 cm
- **Nasal Rasp:** double-ended, fine, length 21.5 cm
- **Same:** coarse (rasp),
- **Nasal Rasp:** tungsten carbide, double-ended, rasp blades Fig. 1 and 2, coarse, length 20.5 cm
- **Behrbohm Rasp:** diamond coated, rasp blade 6 x 15 mm, length 18 cm
- **Behrbohm Rasp:** coarse teeth, cuts with traction, rasp blade 6 x 15 mm, length 18 cm
- **Behrbohm Rasp:** crosscut, cuts with traction, rasp blade 6 x 15 mm, length 18 cm
- **Behrbohm Curette:** 6 x 15 mm, length 18 cm
- **Cottle Metal Mallet:** length 18 cm
- **Killian-Struycken Nasal Speculum:** with set rack, blade length 40 mm, length 15 cm
- **Cottle Nasal Speculum:** blade length 55 mm, length 13 cm
- **Killian-Struycken Nasal Speculum:** with set rack, blade length 75 mm, length 15 cm
- **Blakesley Nasal Forceps:** straight, size 1, working length 11 cm
- **Same:** size 3
- **Craig Septum Forceps:** straight, working length 9 cm
- **Neivert-Masing Needle Holder:** thumb ring upturned, one jaw with groove, length 13 cm
- **Crire-Wood Needle Holder:** length 15 cm
- **Needle Holder:** extra delicate, slight spring action, length 17 cm
Instrument Set for Functional and Aesthetic Septo-Rhinoplastic

529307 FRAZIER Suction Tube, with mandrel and cut-off hole, with distance marking at 5 – 9 cm, 7 Fr., working length 10 cm
529309 Same, 9 Fr.
534500 COTTLE Columella Clamp, length 11 cm
523913 Metal Tray, for preparing cartilage and bone, with hole for towel forceps, size 10 x 15 cm
529105 Suction Tube, curved, outer diameter 5 mm, length 16.5 cm

Instrument Set for Adjunctive Endoscopic Correction of the Nasal Septum and Lamina perpendicularis

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
7230 AA HOPKINS® Straight Forward Telescope 0°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green
426516 JANSEN Nasal Dressing Forceps, bayonet-shaped, length 16.5 cm
449002 HEYMANN Nasal Scissors, medium, (standard model), working length 9.5 cm
449003 Same, large, working length 11 cm
449201 RHINOFORCE® II Nasal Scissors, straight, with cleaning connector, working length 13 cm
449202 Same, curved to right
449203 Same, curved to left
456003 BLAKESLEY Nasal Forceps, straight, size 3, working length 11 cm
474000 FREER Elevator, double-ended, semisharp and blunt, length 20 cm
488038 RUBIN Septum Morcelizer, with double joint, straight, special matt finish, length 20 cm
529305 FRAZIER Suction Tube, with mandrel and cut-off hole, with distance marking at 5 – 9 cm, 5 Fr., working length 10 cm
629825 KUHN Frontal Ostium Seeker, no. 6, both sides curved 77°, one tip straight, other tip reverse angle, length 22 cm
208000 Surgical Handle, Fig. 3, length 12.5 cm, for Blades 208010 – 15, 208210 – 15
748000 Surgical Handle, Fig. 7, length 16.5 cm, for Blades 208010 – 15, 208210 – 15
208210 Blade, Fig. 10, sterile, package of 100

Instrument Set for Repositioning Nasal Bone Fractures

525870 BEHRBOHM-KASCHKE Straightening Elevator for fractures of the nasal bone and zygomatic Arc. Set of 2 right and left, double-ended, length 27 cm
7230 AA HOPKINS® Straight Forward Telescope 0°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green
403240 KILLIAN-STRUYCKEN Nasal Speculum, with set rack, blade length 40 mm, length 15 cm
403265 Same, blade length 65 mm
426516 JANSEN Nasal Dressing Forceps, bayonet-shaped, length 16.5 cm
529305 FRAZIER Suction Tube, with mandrel and cut-off hole, with distance marking at 5 – 9 cm, 5 Fr., working length 10 cm
474000 FREER Elevator, double-ended, semisharp and blunt, length 20 cm

KARL STORZ Paranasal Sinus Shaver System for Olfactory Cleft Surgery

40 701601-1 UNIDRIVE® S III ENT SCB, motor control unit with color display, touch screen, two motor outputs, integrated irrigation pump and SCB module, power supply 100 – 240 VAC, 50/60 Hz including:
Mains Cord
Irrigator Rod
Two-Pedal Footswitch, two-stage, with proportional function
Silicone Tubing Set, for irrigation, sterilizable
Clip Set, for use with silicone tubing set
SCB Connecting Cable, length 100 cm
Single Use Tubing Set*, sterile, package of 3

Accessories

40 712050 DrillCut-X® II Shaver Handpiece, for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS
280053 B Universal Spray, 500 ml bottle, – HAZARDOUS GOODS – UN 1950, for use with Spray Nozzle 280053 C for INTRA drill handpieces
280053 C Spray Nozzle, for the reprocessing of INTRA burr handpieces, for use with Universal Spray 280053 B
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
39550 A Wire Tray, provides safe storage of accessories for KARL STORZ paranasal sinus shaver systems during cleaning and sterilization

* mtp medical technical promotion gmbh,
Take-Off GewerbePark 46, D-78579 Neuhausen ob Eck, Germany

It is recommended to check the suitability of the product for the intended procedure prior to use.
Headlight KS60
Cold-Light Illumination

310060

**Headlight KS60**, with double lens system and Y-fiber optic light cable, >175,000 lux, illuminated area adjustable from 20 – 80 mm with 40 cm working distance,
including:
- **Headlight KS60**, with removable and sterilizable Focus Handle 310065
- **Headband**, fully adjustable, with Forehead Cushion 078511, with cross band, including holder for Headlight 310063
- **Y-Fiber Optic Light Cable**, with special protective casing for Headlight 310063, length 290 cm
- **Clip with Band**, for attaching the fiber optic light cable to OR clothing

HOPKINS® Telescope – 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 BA

**HOPKINS® Forward-Oblique Telescope 30°**, enlarged view, diameter 2.7 mm, length 18 cm, **autoclavable**, fiber optic light transmission incorporated, color code: red

7229 FA

**HOPKINS® Forward-Oblique Telescope 45°**, enlarged view, diameter 2.7 mm, length 18 cm, **autoclavable**, fiber optic light transmission incorporated, color code: black

7229 CA

**HOPKINS® Lateral Telescope 70°**, enlarged view, diameter 2.7 mm, length 18 cm, **autoclavable**, fiber optic light transmission incorporated, color code: yellow
HOPKINS® Telescopes – autoclavable
Diameter 4 mm, length 18 cm

7230 AA  HOPKINS® Straight Forward Telescope 0°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green

7230 BA  HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red

7230 FA  HOPKINS® Forward-Oblique Telescope 45°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: black

7230 CA  HOPKINS® Lateral Telescope 70°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: yellow

Accessories
for use with HOPKINS® Telescopes

723770  STAMMBERGER Telescope Handle, flat, standard model, length 11 cm, for use with HOPKINS® straight forward telescopes 0° with diameter 4 mm and length 18 cm

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

723750 B Protection Tube, working length 19.7 cm, for use with HOPKINS® telescopes with length 18 cm
KILLIAN-STRUYCKEN and COTTLE Nasal Specula
BLAKESLEY Nasal Forceps

<table>
<thead>
<tr>
<th>RUBIN Septum Morcelizer</th>
<th>CRAIG Septum Forceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>403240–403275</td>
<td>488038</td>
</tr>
<tr>
<td>403655</td>
<td>466000</td>
</tr>
</tbody>
</table>

403240 \(\text{KILLIAN-STRUYCKEN Nasal Speculum, with set rack, blade length 40 mm, length 15 cm}\)
403265 \(\text{Same, blade length 65 mm}\)
403275 \(\text{Same, blade length 75 mm}\)
403655 \(\text{COTTLE Nasal Speculum, blade length 55 mm, length 13 cm}\)
456001 \(\text{BLAKESLEY Nasal Forceps, straight, size 1, working length 11 cm}\)
456003 \(\text{Same, size 3}\)

488038 \(\text{RUBIN Septum Morcelizer, with double joint, straight, special matt finish, length 20 cm}\)
466000 \(\text{CRAIG Septum Forceps, straight, working length 9 cm}\)
## Nasal Forceps and Scissors

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>449002</td>
<td>HEYMANN Nasal Scissors, medium, (standard model), working length 9.5 cm</td>
<td></td>
</tr>
<tr>
<td>449003</td>
<td>Same, large, working length 11 cm</td>
<td></td>
</tr>
<tr>
<td>468500</td>
<td>BECKER-CAPLAN Septum Scissors, double action jaws, serrated, working length 9.5 cm</td>
<td></td>
</tr>
<tr>
<td>489091</td>
<td>COTTLE Dorsal Scissors, angular, with tungsten carbide inserts, heavy, working length 7.5 cm</td>
<td></td>
</tr>
<tr>
<td>513200</td>
<td>WALTER Scissors, angled, length 10 cm</td>
<td></td>
</tr>
<tr>
<td>449201</td>
<td>RHINOFORCE® II Nasal Scissors, straight, with cleaning connector, working length 13 cm</td>
<td></td>
</tr>
<tr>
<td>449202</td>
<td>Same, curved to right</td>
<td></td>
</tr>
<tr>
<td>449203</td>
<td>Same, curved to left</td>
<td></td>
</tr>
</tbody>
</table>
“The Diamond Standard”
– Scissors with ultimate cutting quality –

511010 DS  Scissors, extra delicate, straight, sharp/sharp, length 10.5 cm, color code: one gold-plated handle ring
511210 DS  Scissors, extra delicate, curved, sharp/sharp, length 10.5 cm, color code: one gold-plated handle ring
511414 DS  JOSEPH Scissors, curved, length 14 cm, color code: one gold-plated handle ring
513410 DS  COTTLE Scissors, curved, length 10.5 cm, color code: one gold-plated handle ring
513700 DS  FOMON Scissors, curved surface, slender, working length 6.5 cm, color code: one gold-plated handle ring

Retractors

505000  COTTLE Retractor, two prongs, sharp prong on left, blunt prong on right, width 10 mm, length 14.5 cm
505100  Same, sharp prong on right, blunt prong on left
499101  Hook, one prong, large curve, length 16.5 cm
488060  Ala Double Hook, with octagonal handle, with 2 sharp points, strongly curved, special matt finish, width 2 mm, length 16.5 cm
506400  AUFRICHT Nasal Retractor, width of retractor blade 8 mm, length of retractor blade 40 mm, length 16.5 cm
### Chisels, Osteotomes and Mallet

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>484004</td>
<td>COTTLE Chisel, flat, graduated, straight, width 4 mm, length 18.5 cm</td>
</tr>
<tr>
<td>484007</td>
<td>Same, width 7 mm</td>
</tr>
<tr>
<td>484009</td>
<td>Same, width 9 mm</td>
</tr>
<tr>
<td>484106</td>
<td>COTTLE Chisel, flat, graduated, curved, width 6 mm, length 18.5 cm</td>
</tr>
<tr>
<td>484206</td>
<td>COTTLE Crossbar Osteotome, graduated, double-edged grinding, straight, width 6 mm, length 18.5 cm</td>
</tr>
<tr>
<td>484406</td>
<td>Same, single-edged grinding, curved</td>
</tr>
<tr>
<td>486102</td>
<td>WALTER Osteotome, flat, double-edged grinding, width 2 mm, length 19 cm</td>
</tr>
<tr>
<td>486103</td>
<td>Same, width 3 mm</td>
</tr>
<tr>
<td>486104</td>
<td>Same, width 4 mm</td>
</tr>
<tr>
<td>486107</td>
<td>Same, width 7 mm</td>
</tr>
<tr>
<td>486222</td>
<td>BEHRBOHM-WALTER Micro Osteotome, extra delicate, long flat blade, double-edged grinding, with round ergonomic handle and finger grip plate, width 2 mm, length 19 cm</td>
</tr>
<tr>
<td>486223</td>
<td>Same, width 3 mm</td>
</tr>
<tr>
<td>486224</td>
<td>Same, width 4 mm</td>
</tr>
<tr>
<td>486223</td>
<td>BEHRBOHM-WALTER Micro Osteotome, curved, extra delicate, with special double cut, with round ergonomic handle and finger grip plate, width 3 mm, length 19 cm</td>
</tr>
<tr>
<td>486243</td>
<td>BEHRBOHM-WALTER Double Concave Hollow Osteotome, extra delicate, with special double-edged grinding, doubleguarded, with round ergonomic handle and finger grip plate, width 3 mm, length 19 cm</td>
</tr>
<tr>
<td>486253</td>
<td>Same, width 4.5 mm</td>
</tr>
<tr>
<td>487010</td>
<td>RUBIN Osteotome, flat, straight, double-edged grinding, rounded corners, with finger grip stabilizer, width of cut 10 mm, length 16.5 cm</td>
</tr>
<tr>
<td>487016</td>
<td>Same, width 16 mm</td>
</tr>
<tr>
<td>174200</td>
<td>COTTLE Metal Mallet, length 18 cm</td>
</tr>
</tbody>
</table>
Elevators, Suction Elevator, Double Hooks

- **FREER Elevator**, double-ended, semisharp and blunt, length 20 cm (474000)
- **FREER Elevator**, double-ended, sharp and blunt, special matt finish, length 20 cm (488074)
- **MASING Elevator**, double-ended, graduated, sharp and blunt, length 22.5 cm (479000)
- **McKENTY Raspatory**, width 4 mm, length 14.5 cm (478304)
- **Same**, width 5 mm (478305)
- **Suction Raspatory**, with stylet, length 19.5 cm (479800)
- **COTTLE Knife Guide and Retractor**, one side with two-pronged nostril retractor, other side with flat retractor, with duct for guide of cut, length 19 cm (505700)
- **BEHRBOHM-KASCHKE Straightening Elevator** for fractures of the nasal bone and zygomatic Arc. Set of 2 right and left, double-ended, length 27 cm (525870)
Nasal Rasps

523600  **Nasal Rasp**, double-ended, fine, length 21.5 cm

523700  **Same**, coarse (rasp)

523812  **Nasal Rasp**, tungsten carbide, double-ended, rasp blades Fig. 1 and 2, coarse, length 20.5 cm

521411  **BEHRBOHM Rasp**, diamond coated, rasp blade 6 x 15 mm, length 18 cm

521415  **BEHRBOHM Rasp**, coarse teeth, cuts with traction, rasp blade 6 x 15 mm, length 18 cm

521417  **BEHRBOHM Rasp**, crosscut, cuts with traction, rasp blade 6 x 15 mm, length 18 cm

521419  **BEHRBOHM Curette**, 6 x 15 mm, length 18 cm
Nasal Dressing Forceps, Cotton Applicator, Columella Clamp, KUHN Frontal Ostium Seeker, REUTER Nasal Splint, BEHRBOHM Caliper

417013 Cotton Applicator, standard model, triangular, serrated, diameter 1.3 mm, length 15 cm

426516 JANSEN Nasal Dressing Forceps, bayonet-shaped, length 16.5 cm

534015 COTTLE Lower Lateral Forceps, bayonet-shaped, with set screw, serrated tips and teeth on the inside, length 15 cm

533022 ADSON Dressing Forceps, serrated, tungsten carbide inserts, length 12 cm

533112 ADSON Tissue Forceps, 1 x 2 teeth, length 12 cm

533212 ADSON-BROWN Tissue Forceps, atraumatic, fine side grasping teeth, length 12 cm

534500 COTTLE Columella Clamp, length 11 cm

629830 KUHN Frontal Sinus Seeker, double-ended, No. 6, both sides curved 77°, one tip straight, other tip reverse angle, length 22 cm

525520 BEHRBOHM Caliper, for plastic surgery, otoplasty, rhinoplasty, reconstructive and aesthetic surgery, with wheel to set and hold the span, as well as a scale for reading the opening interval, measurement range from 5 – 130 mm, caliper arms have 2 removable attachments with atraumatic measurement points 525523 and 1 holder 525525 for disposable skin marker, autoclavable, length 18.5 cm
Needle Holders and Suction Tubes

**Needle Holder**, extra delicate, slight spring action, length 17 cm

**CRILE-WOOD Needle Holder**, length 15 cm

**NEIVERT-MASING Needle Holder**, thumb ring upturned, one jaw with groove, length 13 cm

**FRAZIER Suction Tube**, with mandrel and cut-off hole, with distance marking at 5 – 9 cm, 5 Fr., working length 10 cm

**Same, 7 Fr.**

**Same, 9 Fr.**

**Suction Tube**, curved, outer diameter 5 mm, length 16.5 cm
Knives and Surgical Blades

493000  COTTLE Nasal Knife, rounded edge, length 14 cm
496900  MASING Nasal Knife, curved, roundly tipped blade, length 14 cm
496550  Surgical Handle, for miniature blades, round, length 16.5 cm, for Blades 496764 – 65
496764  Miniature Blade, Fig. 64, round, sterile, package of 25
208000  Surgical Handle, Fig. 3, length 12.5 cm, for Blades 208010 – 15, 208210 – 15
496400  MASING Surgical Handle, length 14 cm, for Blades 208010 – 15, 208210 – 15
748000  Surgical Handle, Fig. 7, length 16.5 cm, for Blades 208010 – 15, 208210 – 15
208210  Blade, Fig. 10, sterile, package of 100
208211  Same, Fig. 11
208215  Same, Fig. 15
523913  Metal Tray, for preparing cartilage and bone, with hole for towel forceps, size 10 x 15 cm
UNIDRIVE® S III ENT SCB/UNIDRIVE® S III ECO
The multifunctional unit for ENT

Special Features:

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

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

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

- Soft start function
- Textual error messages
- Continuously adjustable revolution range
- Maximum number of revolutions and motor torque: Microprocessor-controlled motor rotation speed. Therefore the preselected parameters are maintained throughout the drilling procedure.
- Maximum number of revolutions can be preset
- SCB model with connections to the KARL STORZ Communication Bus (KARL STORZ-SCB)
- Irrigator rod included
## Motor Systems

### Specifications

#### System specifications

<table>
<thead>
<tr>
<th>Mode</th>
<th>Order No.</th>
<th>rpm</th>
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</thead>
<tbody>
<tr>
<td><strong>Shaver mode</strong></td>
<td>40 7120 50, 55</td>
<td>10,000*</td>
</tr>
<tr>
<td><strong>Sinus burr mode</strong></td>
<td>40 7120 50, 55</td>
<td>12,000</td>
</tr>
<tr>
<td><strong>High-speed drilling mode</strong></td>
<td>20 7120 33</td>
<td>60,000/100,000</td>
</tr>
<tr>
<td><strong>Drilling mode</strong></td>
<td>20 7110 33, 1173</td>
<td>40,000/80,000</td>
</tr>
<tr>
<td><strong>Micro saw mode</strong></td>
<td>20 7110 33, 1173</td>
<td>15,000/20,000</td>
</tr>
<tr>
<td><strong>Intranasal drill mode</strong></td>
<td>20 7110 33, 1173</td>
<td>60,000</td>
</tr>
<tr>
<td><strong>Dermatome mode</strong></td>
<td>20 7110 33, 1173</td>
<td>8,000</td>
</tr>
</tbody>
</table>

**Power supply:**

100 – 240 VAC, 50/60 Hz

**Dimensions:**

300 x 165 x 265 mm

**Two outputs for parallel connection of two motors**

**Integrated irrigation pump:**

Flow: adjustable in 9 steps

* Approx. 4,000 rpm is recommended as this is the most efficient suction/performance ratio.

<table>
<thead>
<tr>
<th>Touch Screen:</th>
<th>6.4&quot; / 300 cd/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight:</td>
<td>5.2 kg</td>
</tr>
<tr>
<td>Certified to:</td>
<td>IEC 601-1 CE acc. to MDD</td>
</tr>
<tr>
<td>Available languages:</td>
<td>English, French, German, Spanish, Italian, Portuguese, Greek, Turkish, Polish, Russian</td>
</tr>
</tbody>
</table>
Motor Systems
Special features of high-performance EC micro motor II
and of the high-speed micro motor

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

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

Recommended System Configuration

**UNIDRIVE® S III ENT SCB**

40 7016 20-1

**UNIDRIVE® S III ECO**

40 7014 20

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

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

**UNIDRIVE® S III ECO**, motor control unit with two motor outputs and integrated irrigation pump, power supply 100 – 240 VAC, 50/60 Hz including:

- **Mains Cord**
- **Two-Pedal Footswitch**, two-stage, with proportional function
- **Silicone Tubing Set**, for irrigation, sterilizable
- **Clip Set**, for use with silicone tubing set

---

**Specifications:**

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

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

Two-Pedal Footswitch

Silicone Tubing Set

UNIT SIDE

PATIENT SIDE

High-Speed Micro-Motor

High-Performance EC Micro Motor II

DrillCut-X™ II Shaver Handpiece, for use with UNIDRIVE® S III ECO/ENT/NEURO

DrillCut-X™ II N Shaver Handpiece, optional adaptability to Shaver Tracker, for use with UNIDRIVE® S III ECO/ENT/NEURO

High-Speed Handpiece

INTRA Drill Handpiece

INTRA Drill Handpiece

Shaver Blade

Shaver Blade, curved

Sinus Burr

Intranasal Drill
Optional Accessories
for UNIDRIVE® S III ENT SCB and UNIDRIVE® S III ECO

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>280053</td>
<td><strong>Universal Spray</strong>, 6x 500 ml bottles – HAZARDOUS GOODS – UN 1950 including: <strong>Spray Nozzle</strong></td>
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<tr>
<td>280053 C</td>
<td><strong>Spray Nozzle</strong>, for the reprocessing of INTRA burr handpieces, for use with Universal Spray 280053 B</td>
</tr>
<tr>
<td>031131-10*</td>
<td><strong>Tubing Set</strong>, for irrigation, for single use, sterile, package of 10</td>
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</tbody>
</table>

mtp medical technical promotion gmbh,
Take-Off GewerbePark 46, D-78579 Neuhausen ob Eck, Germany
## DrillCut-X® Shaver Handpieces

**Special Features**

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

**DrillCut-X® II Shaver Handpiece**

40712050

*for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS*

**DrillCut-X® II N Shaver Handpiece**

40712055

*optional adaptability to Shaver Tracker 40800122, for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS*
DrillCut-X® II Shaver Handpiece

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

40712050 DrillCut-X® II Shaver Handpiece, for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS

40712090 Handle, adjustable, for use with DrillCut-X® II 40712050 and DrillCut-X® II N 40712055

Optional Accessory:

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

Special Features:

- Powerful motor
- Absolutely silent running
- Enhanced ergonomics
- Lightweight design
- Oscillation mode for shaver blades, max. 10,000 rpm
- Rotation mode for sinus shavers, max. 12,000 rpm
- Straight suction channel and integrated irrigation
- The versatile DrillCut-X® II Shaver N Shaver Handpiece can be adapted to the individual needs of the user

- Easy hygienic processing, suitable for use in washer and autoclavable at 134 °C
- Quick coupling mechanism facilitates more rapid exchange of working inserts
- Proven DrillCut-X® blade portfolios can be used
- Optional adaptability to Shaver Tracker 40 8001 22
- Allows shaver navigation when used with NPU 40 8000 01

40 7120 55

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

40 7120 90

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

Optional Accessory:

41250 RA

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

Special Features:
- Ergonomic design
- Ultralight construction
- Easy handle control allows individual adjustment
- The adjustable handle can be mounted to DrillCut®-X II or -X II N Shaver Handpiece
- Easy fixation via rotary lock
- Sterilizable

40 7120 90

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

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

Shaver Blades, straight, sterilizable

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

Optional Accessory:

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

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

Shaver Blades, curved 35°/40°, sterilizable

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

Optional Accessory:

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

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

![Shaver Blade Diagram](image)

**Shaver Blades, curved 65°, sterilizable**

<table>
<thead>
<tr>
<th>Detail</th>
<th>for use with</th>
<th>Shaver Blade</th>
</tr>
</thead>
</table>
| 41203 KNF | 40712050 DrillCut-X® II Handpiece  
40712055 DrillCut-X® II N Handpiece | curved 65°, cutting edge serrated forwards, diameter 4 mm, color code: blue-red |
| 41203 KNB | | curved 65°, cutting edge serrated backwards, diameter 4 mm, color code: blue-red |
| 41203 KKF | | curved 65°, cutting edge serrated forwards, double serrated, diameter 4 mm, color code: blue-yellow |
| 41203 KKB | | curved 65°, cutting edge serrated backwards, double serrated, diameter 4 mm, color code: blue-yellow |
| 41203 KKFA | | curved 65°, cutting edge serrated forwards, double serrated, diameter 3 mm, color code: blue-yellow |
| 41203 KKBA | | curved 65°, cutting edge serrated backwards, double serrated, diameter 3 mm, color code: blue-yellow |
| 41203 GNF | | curved 65°, concave cutting edge, oval cutting window, forward opening, diameter 4 mm, color code: blue-green |
| 41203 GNB | | curved 65°, concave cutting edge, oval cutting window, backward opening, diameter 4 mm, color code: blue-green |

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

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

![Shaver Blades, straight](image.png)

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

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

For use with DrillCut-X® II and DrillCut-X® II N
Shaver Blades, curved
for Nasal Sinuses and Skull Base Surgery

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

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

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

![Image of Shaver Blades, curved](image)

<table>
<thead>
<tr>
<th>Shaver Blades, curved 65°, for single use, sterile, package of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Detail</strong></td>
</tr>
<tr>
<td></td>
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<tr>
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<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
**Sinus Burrs, curved**
for Nasal Sinuses and Skull Base Surgery

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

![Image of sinus burr](image)

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

![Wire Tray](image_url)

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

**for storage of:**
- Up to 7 shaver attachments
- Connecting cable

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

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

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

Same, Transmission 1:2 (80,000 rpm)

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

<table>
<thead>
<tr>
<th>Detail</th>
<th>Size</th>
<th>Dia. mm</th>
<th>Standard</th>
<th>Diamond</th>
<th>Diamond coarse</th>
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<tr>
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<td>649723 G</td>
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<tr>
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<td>649670</td>
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<td>649770 G</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

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

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

<table>
<thead>
<tr>
<th>Detail</th>
<th>Size</th>
<th>Dia. mm</th>
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<th>Diamond</th>
<th>Diamond coarse</th>
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<td>649660 L</td>
<td>649760 L</td>
<td>649760 GL</td>
<td></td>
</tr>
<tr>
<td>070</td>
<td>7</td>
<td>649670 L</td>
<td>649770 L</td>
<td>649770 GL</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

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

280033  **Rack**, for 36 straight shaft burrs with a length of 9.5 cm, foldable, sterilizable, size 22 x 14 x 2 cm

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

**NEW** 280043  **Rack**, flat model, to hold 21 straight shaft burrs with a length of 7 cm (6 pcs) and 9.5 cm (15 pcs), folding model, sterilizable, size 17.5 x 11.5 x 1.2 cm

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

39552 A  **Wire Tray**, provides safe storage of accessories for KARL STORZ drilling/grinding systems during cleaning and sterilization, includes tray for small parts, for use with Rack 280030, rack **not** included

**for storage of:**
- Up to 6 drill handpieces
- Connecting cable
- EC micro motor
- Small parts

39552 B  **Wire Tray**, provides safe storage of accessories for KARL STORZ drilling/grinding systems during cleaning and sterilization, includes tray for small parts, for use with Rack 280030, rack **included**

**for storage of:**
- Up to 6 drill handpieces
- Connecting cable
- EC micro motor
- Up to 36 drill bits and burrs
- Small parts

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

For use with High-Speed Drills, shaft diameter 3.17 mm and with High-Speed Micro Motor 20 7120 33

100,000 rpm
diameter 7.5 mm

20 7120 33

252681

High-Speed Handpiece, medium, angled, 100,000 rpm, for use with High-Speed Micro-Motor 20 7120 33

252682

High-Speed Handpiece, long, angled, 100,000 rpm, for use with High-Speed Micro-Motor 20 7120 33
**UNIDRIVE® S III ENT SCB**
High-Speed Handpieces, angled, 60,000 rpm

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

<table>
<thead>
<tr>
<th>Handpiece Code</th>
<th>Description</th>
<th>Shaft Diameter</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>20712033</td>
<td><strong>High-Speed Handpiece</strong></td>
<td>5.5 mm</td>
<td>51 mm</td>
</tr>
<tr>
<td>252661</td>
<td><strong>High-Speed Handpiece</strong></td>
<td>5.5 mm</td>
<td>71 mm</td>
</tr>
<tr>
<td>252662</td>
<td><strong>High-Speed Handpiece</strong></td>
<td>5.5 mm</td>
<td>91 mm</td>
</tr>
</tbody>
</table>

60,000 rpm

Diameter 5.5 mm
UNIDRIVE® S III ENT SCB
High-Speed Handpieces, straight, 60,000 rpm

For use with High-Speed Drills, shaft diameter 2.35 mm
and with High-Speed Micro Motor 20712033

60,000 rpm
diameter 5.5 mm

252691  High-Speed Handpiece, short, straight, 60,000 rpm,
for use with High-Speed Micro-Motor 20712033

252692  High-Speed Handpiece, medium, straight, 60,000 rpm,
for use with High-Speed Micro-Motor 20712033
UNIDRIVE® S III ENT SCB
High-Speed Handpieces, malleable, slim, angled, 60,000 rpm

For use with High-Speed Drills, shaft diameter 1 mm and with High-Speed Micro Motor 20 7120 33

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 20 7120 33

252672 High-Speed Handpiece, super long, malleable, slim, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33
### UNIDRIVE® S III ENT SCB
High-Speed Standard Burrs, High-Speed Diamond Burrs

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

![Images of burrs](#)

#### High-Speed Standard Burrs, 100,000 rpm, sterile, package of 5

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>medium</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>350110 M</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>350120 M</td>
<td>350120 L</td>
</tr>
<tr>
<td>3</td>
<td>350130 M</td>
<td>350130 L</td>
</tr>
<tr>
<td>4</td>
<td>350140 M</td>
<td>350140 L</td>
</tr>
<tr>
<td>5</td>
<td>350150 M</td>
<td>350150 L</td>
</tr>
<tr>
<td>6</td>
<td>350160 M</td>
<td>350160 L</td>
</tr>
<tr>
<td>7</td>
<td>350170 M</td>
<td>350170 L</td>
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</tbody>
</table>

#### High-Speed Diamond Burrs, 100,000 rpm, sterile, package of 5

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>medium</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>350210 M</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>350220 M</td>
<td>350220 L</td>
</tr>
<tr>
<td>3</td>
<td>350230 M</td>
<td>350230 L</td>
</tr>
<tr>
<td>4</td>
<td>350240 M</td>
<td>350240 L</td>
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<tr>
<td>5</td>
<td>350250 M</td>
<td>350250 L</td>
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<tr>
<td>6</td>
<td>350260 M</td>
<td>350260 L</td>
</tr>
<tr>
<td>7</td>
<td>350270 M</td>
<td>350270 L</td>
</tr>
</tbody>
</table>
UNIDRIVE® S III ENT SCB
High-Speed Diamond Burrs, High-Speed Acorn, High-Speed Barrel Burrs, High-Speed Neuro Fluted Burrs

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

100,000 rpm
diameter 7.5 mm

<table>
<thead>
<tr>
<th>High-Speed Coarse Diamond Burrs, 100,000 rpm, for single use, sterile, package of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter in mm</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High-Speed Acorn, 100,000 rpm, for single use, sterile, package of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter in mm</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>7.5</td>
</tr>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High-Speed Barrel Burrs, 100,000 rpm, for single use, sterile, package of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter in mm</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>9.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High-Speed Neuro Fluted Burrs, 100,000 rpm, for single use, sterile, package of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter in mm</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>1.8</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>
UNIDRIVE® S III ENT SCB
High-Speed Standard Burrs, High-Speed Diamond Burrs

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

High-Speed Standard Burrs, 60,000 rpm, for single use, sterile, package of 5

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>short</th>
<th>medium</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>330110 S</td>
<td>330110 M</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>330120 S</td>
<td>330120 M</td>
<td>330120 L</td>
</tr>
<tr>
<td>3</td>
<td>330130 S</td>
<td>330130 M</td>
<td>330130 L</td>
</tr>
<tr>
<td>4</td>
<td>330140 S</td>
<td>330140 M</td>
<td>330140 L</td>
</tr>
<tr>
<td>5</td>
<td>330150 S</td>
<td>330150 M</td>
<td>330150 L</td>
</tr>
<tr>
<td>6</td>
<td>330160 S</td>
<td>330160 M</td>
<td>330160 L</td>
</tr>
<tr>
<td>7</td>
<td>330170 S</td>
<td>330170 M</td>
<td>330170 L</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>short</th>
<th>medium</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6</td>
<td>330206 S</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1</td>
<td>330210 S</td>
<td>330210 M</td>
<td>–</td>
</tr>
<tr>
<td>1.5</td>
<td>330215 S</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>330220 S</td>
<td>330220 M</td>
<td>330220 L</td>
</tr>
<tr>
<td>3</td>
<td>330230 S</td>
<td>330230 M</td>
<td>330230 L</td>
</tr>
<tr>
<td>4</td>
<td>330240 S</td>
<td>330240 M</td>
<td>330240 L</td>
</tr>
<tr>
<td>5</td>
<td>330250 S</td>
<td>330250 M</td>
<td>330250 L</td>
</tr>
<tr>
<td>6</td>
<td>330260 S</td>
<td>330260 M</td>
<td>330260 L</td>
</tr>
<tr>
<td>7</td>
<td>330270 S</td>
<td>330270 M</td>
<td>330270 L</td>
</tr>
</tbody>
</table>
**UNIDRIVE® S III ENT SCB**

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

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

---

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

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>short</th>
<th>medium</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>330330 S</td>
<td>330330 M</td>
<td>330330 L</td>
</tr>
<tr>
<td>4</td>
<td>330340 S</td>
<td>330340 M</td>
<td>330340 L</td>
</tr>
<tr>
<td>5</td>
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<td>330350 M</td>
<td>330350 L</td>
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<td>6</td>
<td>330360 S</td>
<td>330360 M</td>
<td>330360 L</td>
</tr>
<tr>
<td>7</td>
<td>330370 S</td>
<td>330370 M</td>
<td>330370 L</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>short</th>
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<tbody>
<tr>
<td>4</td>
<td>330440 S</td>
</tr>
<tr>
<td>6</td>
<td>330460 S</td>
</tr>
</tbody>
</table>

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

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

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

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

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

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

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

Dashboard

Live menu

Intelligent icons

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

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

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

---

**FULL HD image**

**CLARA**

**FULL HD image**

**CHROMA**

**FULL HD image**

**SPECTRA A**

---

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

TC 200EN* IMAGE1 S CONNECT, connect module, for use with up to 3 link modules, resolution 1920 x 1080 pixels, with integrated KARL STORZ-SCB and digital Image Processing Module, power supply 100–120 VAC/200–240 VAC, 50/60 Hz including:
- Mains Cord, length 300 cm
- DVI-D Connecting Cable, length 300 cm
- SCB Connecting Cable, length 100 cm
- USB Flash Drive, 32 GB, USB silicone keyboard, with touchpad, US

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

Specifications:
- HD video outputs: - 2x DVI-D
- Format signal outputs: 1920 x 1080p, 50/60 Hz
- LINK video inputs: 3x
- USB interface: 4x USB, (2x front, 2x rear)
- SCB interface: 2x 6-pin mini-DIN
- Power supply: 100–120 VAC/200–240 VAC
- Power frequency: 50/60 Hz
- Protection class: I, CF-Defib
- Dimensions w x h x d: 305 x 54 x 320 mm
- Weight: 2.1 kg

For use with IMAGE1 S

TC 300

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:
- Camera System Supported camera heads/video endoscopes: TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S)
- LINK video outputs: 1x
- Power supply: 100–120 VAC/200–240 VAC
- Power frequency: 50/60 Hz
- Protection class: I, CF-Defib
- Dimensions w x h x d: 305 x 54 x 320 mm
- Weight: 1.86 kg

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

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

**TH 100**

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

**Specifications:**

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

**TH 104**

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

**Specifications:**

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

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

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

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

**Specifications:**

<table>
<thead>
<tr>
<th>KARL STORZ HD and FULL HD Monitors</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop with pedestal</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>Product no.</td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td>Brightness</td>
<td>200 cd/m² (typ)</td>
<td>500 cd/m² (typ)</td>
</tr>
<tr>
<td>Max. viewing angle</td>
<td>178° vertical</td>
<td>178° vertical</td>
</tr>
<tr>
<td>Pixel distance</td>
<td>0.29 mm</td>
<td>0.3 mm</td>
</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>
<td>7.7 kg</td>
</tr>
<tr>
<td>Rated power</td>
<td>28 W</td>
<td>72 W</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>5–35°C</td>
<td>5–35°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-20–60°C</td>
<td>-20–60°C</td>
</tr>
<tr>
<td>Rel. humidity</td>
<td>max. 85%</td>
<td>max. 85%</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>469.5 x 416 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
</tr>
<tr>
<td>Certified to</td>
<td>EN 60601-1, protection class IPX0</td>
<td>EN 60601-1, UL 60601-1, MDD93/42/EEC, protection class IPX2</td>
</tr>
</tbody>
</table>

**Optional accessories:**
- 9826 SF | Pedestal, for monitor 9826 NB |
- 9626 SF | Pedestal, for monitor 9619 NB |
Fiber Optic Light Cables for Cold Light Illumination

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>495 NL</td>
<td>Fiber Optic Light Cable, with straight connector, diameter 3.5 mm, length 180 cm</td>
</tr>
<tr>
<td>495 NA</td>
<td>Same, size 3.5 mm, length 230 cm</td>
</tr>
</tbody>
</table>

Cold Light Fountain XENON 300 SCB

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20133101-1</td>
<td>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</td>
</tr>
<tr>
<td>20133027</td>
<td>Spare Lamp Module XENON with heat sink, 300 watt, 15 volt</td>
</tr>
<tr>
<td>20133028</td>
<td>XENON Spare Lamp, only, 300 watt, 15 volt</td>
</tr>
</tbody>
</table>

Cold Light Fountain Power LED 175 SCB

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20161401-1</td>
<td>Cold Light Fountain Power LED 175 SCB, with integrated SCB, high-performance LED and one KARL STORZ light outlet, power supply 110–240 VAC, 50/60 Hz including: Cold Light Fountain Power LED Mains Cord SCB Connecting Cable, length 100 cm</td>
</tr>
<tr>
<td>20132026</td>
<td>Xenon-Spare-Lamp, 175 watt, 15 volt</td>
</tr>
</tbody>
</table>
Equipment Cart

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

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

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
Notes:
Notes: