TRANSCANAL ENDOSCOPIC MANAGEMENT OF CHOLESTEATOMA

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Introduction

Although it has been two decades since the first use of operative endoscopy for the exploration of old mastoid cavities, the endoscope is used infrequently in the day-to-day surgical management of ear disease around the globe for several reasons. The role of the endoscope as defined by many prominent otologists is so marginal that most surgeons have not felt compelled to master newer techniques and instrumentation for its use. In effect, the use of the endoscope did not significantly benefit either the patient or the surgeon. In addition, most physicians have focused on the use of smaller diameter endoscopes for ear surgery, which is very frustrating and eliminates the main (and possibly the only) advantage of endoscopy (the wide field of view provided by the endoscope is greater than that of the microscope). This author first used the endoscope in ear surgery in 1993 during years of practice in the United States. In recent years, it has replaced the microscope as the instrument of choice for use in middle ear surgery. The endoscope offers a new perspective of cholesteatoma and related surgical procedures by increasing the surgeon’s understanding of that disorder and its progression through the temporal bone. Clinicians who use the endoscope during ear surgery realize how the microscope and its limitations have colored the clinical perception of cholesteatoma and have dictated its management.

History

The introduction of the binocular operating microscope, which was a landmark event in the development of modern otology, clearly changed the scope and character of ear surgery. Despite continuous technical improvements, however, basic optical principles and their limitations have remained the same over the last the decades. The use of the endoscope in various surgical procedures was extrapolated to otologic surgery, and the diagnostic and photographic use of that instrument in the examination of the tympanic membrane and the ear canal has been widely publicized. Transtympanic middle ear endoscopy was initially reported by Nomura and Takahashi and colleagues. Poe and Bottrill used transtympanic endoscopy for the confirmation of perilymphatic fistula and the identification of other middle ear pathologic conditions. Kakehata used microendoscopy and transtympanic endoscopy for evaluation of conductive hearing loss and inspection of retraction pockets. Thomassin and colleagues reported on operative ear endoscopy for mastoid cavities and designed an instrument set to be used for that purpose. Badr-el-Dine and El-Messelaty reported on the value of endoscopy as an adjunct in cholesteatoma surgery and documented a reduced risk of recurrence when the endoscope was used. The reduction in residual disease was further confirmed by Yung and Ayache. Abdel Baki reported on using endoscopic technique to evaluate disease within the sinus tympani. Mattox reported on endoscopy-assisted surgery of the petrous apex. Magnan and Sanna, Bader-el-Dine and El-Garem, and Rosenberg and colleagues reviewed the role of the endoscope in neurotologic procedures. McKennan described the second-look endoscopic inspection of mastoid cavities that was achieved through a small postauricular incision. More recently, Presutti and Marchioni, have described primary transcanal endoscopic ear surgery in a similar fashion to the experience reported here.

Instrumentation

In the procedures described in this report, 4-mm wide-angle zero-degree and 30-degree HOPKINS telescopes that were 18 cm in length were most often used. More recently, a smaller 3mm endoscope that has a very similar field of view to the 4mm endoscope has been used. Other smaller diameter scopes have been used sparingly. Video equipment consisted of a 3-chip video camera and a monitor. All procedures were performed directly off the monitor and were recorded. Instruments used in conjunction with routine microscopic ear surgery (Fig. 1).
Discussion

The rationale, advantages, limitations, technique, and long-term results of the technique will be discussed in the following sections.

Rationale for Endoscopic Ear Surgery

Acquired cholesteatoma is usually a manifestation of advanced retraction of the tympanic membrane that occurs when the sac advances into the tympanic cavity proper and then into its extensions such as the sinus tympani, the facial recess, the hypotympanum, and the attic. Only in advanced cases does a cholesteatoma progress further to reach the mastoid cavity proper. Most surgical failures associated with a postauricular approach seem to occur within the tympanic cavity and its hard-to-reach extensions rather than in the mastoid. Therefore, the most logical approach to the excision of a cholesteatoma involves transcanal access to the tympanic membrane and tympanic cavity and the subsequent step-by-step pursuit of the sac as it passes through the middle ear. Mainstream ear surgery has usually involved the mastoid and the postauricular approaches because operating with the microscope through the auditory canal is a very frustrating and almost impossible process. The view during microscopic surgery is defined and limited by the narrowest segment of the ear canal (Fig. 2). This basic limitation has forced surgeons to create a parallel port through the mastoid to gain keyhole access to the attic, the facial recess, and the hypotympanum (Fig. 3). In contrast, transcanal operative endoscopy bypasses the narrow segment of the ear canal and provides a wide view that enables surgeons to look “around the corner,” even when a zero-degree endoscope is used (Fig. 2). Another anatomic observation that supports transcanal access to the attic, which is the most frequent site of cholesteatoma, is the orientation of the ear canal in relation to the attic. Figure 4 shows a coronal computed tomographic section through the temporal bone, which reveals that an axis line drawn through the ear canal ends in the attic rather than the mesotympanum. The only structure that is in the way is the scutum, and its removal allows wide and open access to the attic, which is the natural cul de sac of the external auditory canal. Rediscovering the ear canal as the access port for cholesteatoma surgery is the main story and the main advantage of endoscopic ear surgery. This allows a more natural and direct access and pursuit of cholesteatoma within the middle ear cleft. In contrast, traditional approaches to the attic and facial recess have provided primarily keyhole access through postauricular mastoidectomy, and many surgeons use the ear canal to access the anterior part of the attic, even during postauricular tympanomastoidectomy. Other areas, such as the hypotympanum and sinus tympani, are minimally accessible even with extensive postauricular mastoidectomy. The wide view provided by the endoscope enables minimally invasive transcanal access to all those areas and facilitates the complete extirpation of disease without the need for a postauricular approach or incision.
Transcanal Endoscopic Anatomy of the Tympanic Cavity

As discussed earlier, the transcanal endoscopic approach provides a fresh new way of looking at the anatomy of the tympanic cavity and more specifically the cholesteatoma bearing areas of that cavity. The endoscope also allows a better understanding of the ligaments and folds of the middle ear and how they affect ventilation of these different spaces. This section would highlight the anatomy of some areas and reviews the concept of the epitympanic diaphragm which plays an important role in the pathophysiology of attic cholesteatoma.31-33

Facial Recess

Using the transcanal endoscopic approach, the facial recess becomes very accessible and more of a shallow depression on the posterior wall of the tympanic cavity (Fig. 5). In contrast, the postauricular posterior tympanotomy provides a keyhole access to this important area. The pyramidal eminence, along with the vertical segment of the facial nerve, forms the medial wall of the recess and it helps mark the depth of the vertical segment of the facial nerve in that area. The bony annulus that forms the lateral wall of the recess can be taken down safely as long as the pyramidal eminence is continuously observed and kept in view. The relationship of the bony annulus to the vertical segment of the facial nerve is very variable as we move inferiorly beyond the pyramidal eminence and great care should be paid when removing bone from the inferior/posterior aspect of the ear canal and bony annulus.

Retrotympanum: When observing the anatomy of the Retrotympanum, it is useful to start by identifying the footplate and the round window. The footplate is located within the posterior sinus that extends around it and posterior to it. The round window is located within the sinus subtympanicum that extends posterior and inferior to it. In between these two sinuses lie the sinus tympani (Fig. 6). It is a useful exercise during surgery to start superiorly with the posterior sinus and the footplate, and move inferiorly, identifying the ponticulus promontorii, the sinus tympani, the subiculum, and ending up with the sinus subtympanicum where the round window is located (Fig. 7). Inferior to that you can find the hypotympanum which is separated from the sinus subtympanicum by the finiculus (Fig. 8).

Attic: The attic forms a compartment that is distinct and separate from the mesotympanum both anatomically and in terms of aeration. Attic retraction pocket present often as an isolated finding with normal ventilation and findings within the mesotympanum. The concept of the epitympanic diaphragm had been advocated and advanced by multiple clinicians and histologists and pathologist of the temporal bone.31-33 However, this concept did not make much of an inroad on the clinical side because of the difficulty in communicating and understanding the difficult anatomy. The endoscope allows a much better understanding of the anatomy of the attic and the reason that this area is distinct and separate from the rest of the middle ear in terms of ventilation.

A schematic drawing of the retrotympanum in the right ear. It is useful to start superiorly at the oval window and move inferiorly: from the posterior sinus, then the sinus tympani, the sinus subtympanicum, and the hypotympanum.

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The attic is a highly complex anatomical space with the bulk of the ossicular chains and many suspensory ligaments and folds. In the lateral attic, the lateral incudomallear and lateral mallear fold forms a lateral wall that does not allow for ventilation of the attic via the mesotympanum laterally (Fig. 9). The anterior part of these lateral folds forms the medial wall of Prussak’s space. The anterior attic is often separated from the anterior mesotympanum and the Eustachian tubes by the tensor tympani folds. There are two main variations of this structure: The first is an almost horizontal orientation where the folds attach to the tensor tendon posteriorly and to the tympanic wall anteriorly very close to the anterior tympanic spine (Figs. 10, 11). The second is when the supratubal recess is well developed and when it pushes the folds almost to a vertical position (Fig. 12). The attic and the supratubal recess are two distinct areas anatomically and developmentally. Anatomically, the supratubal recess is often a smooth walled cavity, in contrast, the attic wall has numerous tags and excrescences. The transverse crest is a semicircular bony ridge that starts at the medial wall of the attic, runs across the roof, and then the lateral wall of the attic and marks the border between the tags and excrescence filled anterior attic and the smooth walled supratubal recess (Fig. 13). Its medial limb starts from the area of the cochleariform process and forms the COG, a commonly recognized surgical term and a bony protrusion on the medial anterior attic wall.34 The tensor fold always inserts more anteriorly than the COG and that leaves a space for the entrapment of cholesteatoma (Fig. 14).

Left Ear: The lateral attic is closed off from the mesotympanum by the lateral Incudo-Mallear and Mallear ligament. Please note the relatively straight insertion line of the Lateral Incudo Mallear ligament (IML) and the downward sloping insertion line of the Lateral Mallear Ligament (LML).

Right ear: Poorly developed supratubal recess in a surgical case. Using a 70 degree endoscope and looking up and backwards. The tensor fold in these settings is almost a horizontal structure. HM: handle of malleus; TTM: tensor tympani muscle; TF: tensor fold; ABA: Anterior bony annulus.

Left ear: The lateral attic is closed off from the mesotympanum by the lateral Incudo-Mallear and Mallear ligament. Please note the relatively straight insertion line of the Lateral Incudo Mallear ligament (IML) and the downward sloping insertion line of the Lateral Mallear Ligament (LML).

Right ear: close up view of the tensor fold seen in figure 32. TF: tensor fold; TTM: tensor tympani muscle bony encasement; TTT: tensor tympani tendon inserting on the neck of the malleus.

Left ear: The anatomy of the tensor fold in a specimen with a well developed supratubal recess. The tensor fold is composed of two segments, a vertical part that attaches to the COG and a horizontal part that forms a partial floor of the supratubal recess. STS = Supratubal recess; COG = the surface of Sheehy’s Cog which separates the supratubal recess from the anterior attic; TFA = the vertical segment of the tensor fold which when complete, will close off the attic from the Eustachian tube; TFB = the horizontal segment of the tensor fold which forms a partial floor of the supratubal recess anteriorly; TTM = tensor tympani muscle’s bony encasement.

Left Ear: The tensor tendon is transected and the handle of the malleus is removed, so was the anterior spine, anterior malleolar ligament and the corda tympani. Note the distinction between the smooth wall of the supratubal recess and the numerous tags and excrescences of the anterior attic. COG = Sheehy’s Cog; TM = remnant tensor fold. Single arrows = insertion point of the partially removed vertical segment of the tensor fold; Double arrows = insertion point of the completely removed horizontal segment of the tensor fold; STS = Supratubal recess; ET = Eustachian tube; CG = Cochleariform process; 1G = First genu of the facial nerve and neighboring geniculate ganglion; LC = Lateral semicircular canal.

Intraoperative view from posterior toward the anterior attic in a left ear. FN = Horizontal segment of the facial nerve; HM = Handle of Malleus; CT = The cut edge of the corda tympani; TT = Tensor tympani tendon; TF = The posterior aspect of the tensor fold.
**Developmentally:** The middle ear spaces are formed from four pouches or sacs (the saccus anticus, saccus medius, saccus superior, and saccus posticus) that bud out from the Eustachian tube. The attic is formed from the saccus medius, which divides into three saccules, anterior, medial, and posterior. The supratubal recess may be formed by either the saccus anticus. The anterior saccule of the saccus medius meets the slower growing saccus anticus at the level of the semicanal of the tensor tympani, thus forming the horizontally lined tensor tympani fold. The space thus formed above the tensor fold and anterior to the tensor tendon is the anterior attic compartment. Alternatively, the saccus anticus may occasionally extend upward to the tegmen, pushing the tensor fold into an almost vertical position and in the process, forming a well-developed supratubal space. The expansion from the bony Eustachian tube to form the supratubal recess begins at a late fetal stage and continues throughout childhood. By contrast, growth of the tympanic cavity, the attic, and the mastoid antrum is virtually complete by birth.

In the presence of an intact tensor fold, there is a fully formed diaphragm that separates the attic from the mesotympanum. This diaphragm is formed by the lateral incudomallear and malleolar folds laterally and the tensor folds anteriorly. The only ventilation port is through the anterior and posterior isthmus. The anterior isthmus is the area in between the incudo stapedial joint and the tensor tympani tendon. The posterior isthmus is the area posterior to the incudostapedial joint and is often extremely narrow and has many other structures such as the chorda and the pyramidal eminence. So the anterior isthmus, or the “isthmus” is the main point of attic ventilation with a very long channel that extends medially to the ossicles and then superiorly to the ossicles to ventilate the lateral and anterior attic. This long channel is also populated by other partial folds and suspensory ligaments which provide other opportunities for impaired ventilation.
Basic Techniques and Management Algorithm

There are three basic approaches to the endoscopic management of cholesteatoma that echo principles and lessons learned from traditional tympanomastoid surgical procedures. These are: 1-"transcanal management of limited cholesteatoma", 2-"open endoscopic management of cholesteatoma", and 3-"extended transcanal approach to cholesteatoma". While preoperative planning based on high resolution CT and endoscopic examination is important, the decision is finally made in the operating room and patients need to understand the range of possible interventions. The first question to be answered is whether the ear canal is an adequate port for the complete removal of cholesteatoma. If the answer is yes, then a wide tympanomeatal flap is elevated, atticotomy performed, sac identified and pursued along with removal of overhanging bone, basically all the steps involved in "endoscopic management of limited cholesteatoma". If the answer is no, then the ear canal access is improved through an "extended transcanal approach" by removing the skin and enlarging the canal.

Then the issue of the mastoid will need to be addressed. A limited cholesteatoma that extends to the aditus antrum can be completely removed through a transcanal approach. If the mastoid is involved, then a decision needs to be made whether the disease will be addressed through a postauricular mastoidectomy or whether it will be exteriorized by "endoscopic open cavity management of cholesteatoma" with aggressive bone removal superiorly and posteriorly all the way to the mastoid cavity proper (see Fig. 18).
Endoscopic Transcanal Management of Limited Cholesteatoma

The attic (especially its anterior part) is poorly visualized via traditional approaches. An endoscopic approach enables the surgeon to retrace the sac, starting from the mesotympanum and continuing through its twists and turns around the ossicles and ligaments. This improved access also facilitates the better preservation of the ossicles while ensuring the complete removal of the matrix in toto rather than piecemeal and through different access ports.

Technique

A wide posterior tympanomeatal flap is elevated. The sac is then pursued under direct vision, and the bony rim is curetted or drilled just enough to enable dissection to continue under direct vision. Appropriate ossicular chain work is performed, and the attic defect is closed by means of a composite tragal graft.

Results

Seventy-three ear procedures were performed on the 69 patients; 65 of those individuals underwent unilateral surgery. The results of preoperative computed tomographic scanning of the temporal bone, which was performed in 46 ears, suggested cholesteatoma with the presence of bony erosion in 26 ears. Seven ears showed evidence of total opacification of the middle ear and mastoid air cells (without bone erosion), and isolated opacification of the middle ear and attic was evident in 11 ears. The results of audiologic testing showed an air-bone gap of 20 dB or more in 51 ears. The transcanal endoscopic approach was adequate for the removal of disease in all patients. There were no iatrogenic facial nerve injuries. Bone thresholds were stable; ie, no change of 10 dB or more was noted in average bone conduction thresholds at 500, 1000, 2000, or 3000 Hz. In 24 ears, the cholesteatoma was dissected from the malleus head and the body of the incus, both of which were preserved. The incus or its remnant was removed in 49 ears, and the head of the malleus was removed in 43 ears. Primary ossicular reconstruction was performed in 38 ears and was delayed in 17 ears. Follow-up was performed at 43 months, on average. Revision for recurrent and clinically evident disease was performed on 5 ears. In 8 ears, a revision procedure was performed to correct a failed ossicular reconstruction or a persistent perforation. In one of those reconstruction failures, a small incidental pearl attached to the underlayer of the tympanic membrane was noted. Moderate-to-severe retraction in other areas of the tympanic membrane was evident in 28 patients, none of whom required further intervention.

Case History

A 46 year old male patient with a long-standing history of problems. Initial evaluation showed severe retraction bilaterally and some granulation tissue and drainage from the right ear. After a week of medical treatment, his right ear showed clear evidence of severe retraction and debris within the cholesteatoma sac (Fig. 19). An endoscopic transcanal approach was undertaken, a wide tympanomeatal flap was elevated, and the middle ear was entered (Fig. 20). A wide atticotomy was performed with a curette (Fig. 21). The cholesteatoma sac was identified; it extended to the lateral attic and was pulled downward laterally to the body of the incus and medially to the removed scutum (Fig. 22). Another process of the sac had rotated posteriorly and medially around the incudostapedial joint and the superstructure of the stapes and had advanced medially to the long process of the incus (Fig. 23). The sac was pulled out completely and was deflected (Fig. 24). It was evident that the sac had eroded the incudostapedial joint (Fig. 25). A prosthesis was used to reconstruct the ossicular chain (Fig. 26). A piece of tragal composite graft with excess perichondrium was used to reconstruct the attic defect (Fig. 27). The tympanic membrane defect was reconstructed with a perichondrial underlay graft, and the tympanomeatal flap was repositioned (Fig. 28). The patient experienced an uneventful postoperative course. One month after the procedure, his tympanic membrane was intact, his hearing was good, and he returned to work.
Right ear. The tympanomeatal flap has been elevated, the middle ear has been entered, and the cholesteatoma sac has been exposed.

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Right ear. A wide atticotomy is performed with a curette.

21

Right ear. The sac (S) has been pulled down from the attic, lateral to the body of the incus and medial to the scutum. The body of the incus (I) can be seen. The chorda (C) forms a collar around the neck of the sac.

22

Right ear. The sac has been completely pulled out and deflected over the tympanomeatal flap with the incus (I) and the chorda (C) in view.

23

Right ear. The sac is removed. The cholesteatoma has eroded the incudostapedial joint (I-S). The incus (I), the chorda (C), and the ponticulus promontorii (P) are clearly in view. The anterior edge of the tympanic membrane retraction (T), now a perforation, is also visible.

24

Right ear. A prosthesis (A) is used to reconstruct the incudostapedial joint. The handle of the malleus (M) and the incus (I) and chorda (C) are visible.

25

Right ear. The attic defect is reconstructed by means of a composite tragal graft (G) with excess perichondrium to prevent retraction around the graft.

26

Right ear. The tympanomeatal flap is repositioned over an underlay graft (UG) to reconstruct the retracted area of the tympanic membrane.

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Endoscopic Open Cavity Management of Cholesteatoma

In canal wall down procedures, which have been viewed as the definitive treatment for cholesteatoma, all disease-containing cavities are exteriorized to provide natural aeration and direct access to the disease in the clinic setting. However, during the process of accessing the diseased areas, large problematic cavities that require lifelong maintenance are created. In addition, unpredictable healing patterns, fibrosis, and closing of the meatus, which are common complications associated with postauricular canal wall down procedures, often prevent further ossicular reconstruction. Endoscopic techniques allow transcanal exploration of the disease-containing cavities without opening up areas that are not involved in the cholesteatoma. Such techniques enable the surgeon to approach and reconstruct the ear in a highly predictable fashion. This in turn creates a better framework for ossicular and partial tympanic membrane reconstruction.

The transcanal endoscopic approach opens up only diseased areas, preserves many healthy air cells, and leaves the cortical bone intact. It also allows for the creation of 2 independent cavities; the small reconstructed tympanic cavity that conducts sound in the middle ear and that is small enough to be serviced by the usually dysfunctional Eustachian tube, and the larger attic, antrum, and mastoid cavities, which are joined to the ear canal and are exteriorized (Fig. 29). Such an approach was described by Tos in 1982. The main concern of many surgeons is the possibility of closing the open attic. That concern is driven by the results of traditional open surgery of the mastoid, in which damage to the cartilaginous portion of the ear canal produces a vicious circle: Trauma to the ear canal results in fibrosis and narrowing of the meatus, which forces the surgeon to design a more aggressive meatoplasty, which in turn results in more trauma, secondary fibrosis, and narrowing. A huge meatus must be created to compensate for that eventual fibrosis and narrowing. In contrast, the very limited trauma to the cartilaginous ear canal caused by endoscopic surgery allows surgeons to avoid those complications and results in small, shallow, benign, problem-free cavities.

Coronal computed tomographic views of a patient who underwent a left ear endoscopic open cavity management of a cholesteatoma. Compare the normal ear to the left operated ear. The neotympanic membrane (NT) is reconstructed up to the level of the horizontal segment of the facial nerve (FN), and the attic is left open (OA).
Technique

In the endoscopic open cavity management of cholesteatoma, the wide posterior tympanomeatal flap is elevated as described above. A transcanal atticotomy is performed. The attic is then emptied from the incus and the head of the malleus. Aggressive bone removal is then performed to provide open endoscopic access into the attic and all the way posteriorly into the antrum. Tympanic membrane defects inferior to the horizontal segment of the facial nerve (including atelectatic areas) are reconstructed with a perichondrial graft, which is placed directly on, and up to the horizontal segment of the facial nerve superiorly and on a bed of Gelfoam that is packed in the middle ear inferiorly. The ear canal and the open attic are then packed with Gelfoam. This technique should result in a small, closed, reconstructed tympanic cavity and membrane anteriorly and inferiorly (to service the impedance-matching function of the middle ear) and an open attic and antrum posteriorly and superiorly (Fig. 29).

Results

Eighty-five ear procedures were performed on 78 patients. There were no iatrogenic facial nerve injuries. Bone thresholds were stable (“stability” was defined as no change of 10 dB or more in average bone-conduction thresholds at 500, 1000, 2000, and 3000 Hz) except in 1 patient who presented preoperatively with depressed bone thresholds, vertigo, and a perilymphatic fistula. The mean follow-up was 32 months. Closure of the air-bone gap to within 20 dB was accomplished in 47 ears. Six ears required revision surgery, four of the surgical failures resulted from complete closure of the open attic by a growth of overlying skin rather than by a step-by-step narrowing of the atticotomy. This complication was usually evident early in the postoperative course and was managed by re-excising the overlying skin in a simple procedure.
Case History

A 41 year old with retraction pocket and recurrent granulation tissue. Figure 30 shows the large attic retraction pocket after it was emptied of dermal debris. A wide tympanomeatal flap was elevated, and the thick vascularized sac can be seen after the atticotomy was extended (Figs. 31, 32). The incus and the head of the malleus were removed after the incudostapedial joint was dislocated (Figs. 33, 34). The anterior epitympanum was cleared of all disease. The remainder of the sac deep to the removed ossicles was removed after further widening of the atticotomy (Fig. 35). All disease was excised, and specific attention was paid to the attic and the tympanic cavity (Fig. 36). A prosthesis was used to reconstruct the ossicular chain (Fig. 37), and a composite cartilage graft was positioned on top of the prosthesis (Fig. 38). The tympanomeatal flap was divided longitudinally (Fig. 39). The inferior part was repositioned over the ear canal, the superior part was draped over the horizontal segment of the facial nerve (Fig. 40), and the attic was packed open.
Transcanal Endoscopic Management of Cholesteatoma

Left ear. The incus has been removed, and the head of the malleus (HM) is extracted. Note that the head of the malleus is separated from the handle by means of a malleus nipper at a proximal site to preserve the ligaments stabilizing the handle of malleus.

\[ \text{SFP} = \text{Stapes footplate}; \]
\[ \text{C} = \text{Chorda tympani} \]

Left ear. The thick sac (S) is being pulled with an alligator forceps (A).
\[ \text{A} = \text{Attic}; \]
\[ \text{P} = \text{Ponticulus promontorii}; \]
\[ \text{C} = \text{Chorda tympani}; \]
\[ \text{SFP} = \text{Stapes footplate}; \]
\[ \text{LS} = \text{Lateral semicircular canal} \]

Left ear. The ossicular chain is reconstructed with the use of a prosthesis (PR).
\[ \text{C} = \text{Chorda tympani}; \]
\[ \text{Su} = \text{Suction} \]

Left ear. Composite tragal cartilage (CG) is used on top of the prosthesis.

Left ear. The tympanomeatal flap is cut longitudinally with middle ear scissors.

Left ear. The inferior part of the tympanomeatal flap (TMF-B) is repositioned over the ear canal while the superior part of the tympanomeatal flap (TMF) is reflected over the horizontal segment of the facial nerve into the open attic (A). Small pieces of Gelfoam (GF) are used to pack the open attic and ear canal.
\[ \text{TM} = \text{Tympanic membrane} \]
Expanded Transcanal Access to Middle Ear and Petrous Apex

Although the use of the endoscope allows much expanded transcanal access to the middle ear when compared with the microscope, the ear canal in some patients can be very limiting in size and angulation as not to allow for adequate exposure. Addressing these limitations prior to addressing the disease is essential for performing adequate and safe endoscopic procedures. As well, this approach would provide wide access to diseased areas within the anterior middle ear, Eustachian tube and the petrous bone.

Technique

After evaluation of the limiting elements in the ear canal in relation to location of the disease, a decision is made on whether to address these limitations. The location of the disease and its extent is determined by endoscopic examination and review of CT of the temporal bone. Anterior middle ear, Eustachian tube, and significant disease within the hypotympanum will often require an expanded transcanal approach. When enlarging the ear canal, the surgeon needs to be keenly aware of critical structures that lie in close proximity (Fig. 41). The bony annulus, the line separating the ear canal from the middle ear, has tremendous variations and one should think of all structures that border the tympanic cavity proper when enlarging the ear canal. Posteriorly, the facial nerve and an anterior sigmoid should be considered. Inferiorly, a high jugular bulb can come laterally and borders the ear canal. Breaching the glenoid fossa anteriorly is usually a non-event, but it can present a limiting factor.

The technique echoes that of Sheehy’s lateral graft tympanoplasty. The skin of the ear canal removed along with the epithelial layer of the tympanic membrane and the vascular strip preserved. The ear canal would be enlarged as needed. Then the annulus and fibrous layer of the tympanic membrane is elevated either completely or partially to provide access to the areas of interest. Then all overhanging bony annulus is curetted and wide access to the middle ear is gained for removal of any disease. After the necessary ossicular chain work, the remaining part of the tympanic membrane is repositioned and a lateral graft is applied and the skin of the ear canal is repositioned and packed in place.
**Case History**

36 year old male presenting with long standing history of right hearing loss and dizziness. Examination showed an anterior whitish lesion behind the tympanic membrane (Fig. 42). Audiometry indicated a dead ear on the right normal hearing in the left. CT of the temporal bone showed extensive petrous bone cholesteatoma eroding the cochlea and the carotid artery (Fig. 43). Using the “expanded transcanal access” technique, the vascular strip is preserved, the ear canal skin is removed, the fibrous layer of the tympanic membrane is preserved, and the ear canal is then enlarged (Fig. 44). The extensive cholesteatoma has eroded the bony encasement of the sinus tympani muscle and carotid and had eroded the middle and apical turns of the cochlea (Fig. 45). The cholesteatoma was completely removed from the apex of the petrous bone (Fig. 46).

**Conclusion**

The story of endoscopic management of cholesteatoma is that of the rediscovering of the ear canal as the most logical, direct, and natural access point to cholesteatoma within the mesotympanum, attic, facial recess, sinus tympanum, hypotympanum, and Eustachian tube. It offers a fresh outlook on this disease and changes the surgical treatment paradigm of cholesteatoma.
References


Set for Endoscopic Ear Surgery
## Instrument Set for Endoscopic Ear Surgery

1. **Ear Hook**, curved right, length 16 cm  
2. **Same**, curved left  
3. **Same**, curved backwards  
4. **Ear Dissector**, curved right, length 16 cm  
5. **Same**, curved left  
6. **Same**, curved backwards  
7. **Curette**, spoon-shaped, diameter 1.0 mm, length 16 cm  
8. **Curette**, double-ended, spoon-shaped tips: diameter 1.0 mm and 1.5 mm, 90° curved, length 17 cm  
9. **Dissector**, double-ended, tips double curved right and left, length 18 cm  
10. **Same**, distal tips with single curve to right or to left  
11. **HOUSE Curette**, medium, spoon sizes 1 x 1.8 mm and 2 x 3.5 mm, length 15 cm  
12. **Suction round knife**, diameter: 3 mm, easy to handle due rotatable tubing connector, length 19 cm  
13. **Suction Cannula**, curved 3 mm, LUER-Lock, outer diameter 0.6 mm, length 10 cm  
14. **Same**, outer diameter 0.8 mm  
15. **Same**, outer diameter 1.0 mm  
16. **Suction Cannula**, curved 6 mm, LUER-Lock, outer diameter 0.8 mm, length 10 cm  
17. **Same**, outer diameter 1.0 mm  
18. **Same**, outer diameter 1.2 mm  
19. **Suction Cannula**, curved 8 mm, LUER-Lock, outer diameter 1.2 mm, length 10 cm  
20. **Same**, outer diameter 1.6 mm, length 10 cm  
21. **FISCH Suction Handle**, with cut-off hole, LUER cone, length 5.5 cm  
22. **LUER Cone Connector**, male, rotating  
23. **Ear Forceps**, curved downwards, retrograde, extra delicate, oval cupped jaws, 0.9 mm, working length 10 cm  
24. **Same**, 45° curved upwards, extra delicate, oval cupped jaws, 0.6 mm  
25. **Same**, 45° curved right  
26. **Same**, 45° curved left

It is recommended to check the suitability of the product for the intended procedure prior to use.
Endoscopic-Guided Middle Ear Diagnosis
Recommended Set according to Dr. M. TARABICHI
HOPKINS® Telescopes and Accessories

1215 AA BA
Tele-Otoscope with HOPKINS® Straight Forward Telescope 0°,
diameter 4 mm, length 6 cm, autoclavable, fiber optic light transmission incorporated,
color code: green

1215 BA
Tele-Otoscope with HOPKINS® Forward-Oblique Telescope 30°,
diameter 4 mm, length 6 cm, autoclavable, fiber optic light transmission incorporated,
color code: red

1230 AA
HOPKINS® Straight Forward Telescope 0°,
diameter 2.7 mm, length 11 cm, autoclavable, fiber optic light transmission incorporated,
color code: green

1230 BA
HOPKINS® Forward-Oblique Telescope 30°,
diameter 2.7 mm, length 11 cm, autoclavable, fiber optic light transmission incorporated,
color code: red

723773
STAMMBERGER Telescope Handle, round, length 6.5 cm,
for use with HOPKINS® telescopes with diameter 2.7/3 mm
and length 11 cm

1218 S
Stand, for 3 tele-otoscopes 1215, 1216, 1218,
cartridges with color codes green, red and yellow, autoclavable,
dimensions: 180 x 105 x 80 mm (w x h x d)

203710
Suction Tube, cylindrical, Luer,
outer diameter 1 mm, working length 9 cm
LED Battery Light Sources for Endoscopes

11301 D4  **LED Battery Light Source for Endoscopes**, with fast screw thread, boost mode for temporary increase in brightness > 110 lm / > 150 klx, burning time > 120 min, weight approx. 150 g ready for use, suitable for wipe disinfection

11301 DE  **Battery Light Source LED for Endoscopes**, rechargeable, with click connection, boost mode for temporary increase in brightness, color temperature 5500 K, lithium-ion batteries, charging time 60 min, burning time at 100% brightness 40 min, weight approx. 150 g, suitable for wipe disinfection

11301 DF  **Battery Light Source LED for Endoscopes**, rechargeable, with fast screw thread, boost mode for temporary increase in brightness, color temperature 5500 K, lithium-ion batteries, charging time 60 min, burning time at 100% brightness 40 min, weight approx. 150 g, suitable for wipe disinfection

11301 DG  **Charging Unit for two LED battery light sources**, with fix integrated power supply and adaptor for EU, UK, USA and Australia, power supply 110 - 240 VAC, 50/60 Hz, suitable for surface disinfection use with: 11301 DE/DF Battery Light Source LED

094129  **Battery Charger Li-Ion**, for charging the rechargeable battery box 094124 or LED-Battery Light Source 11301 DE/DF, for use with mains cord 094127 (only EU connection), power supply 100–240 VAC, 50/60 Hz

094127  **Mains Cord**, for Battery Charger 094129, length 150 cm
Endoscopic-Guided Middle Ear Surgery
Recommended Set according to Dr. M. TARABICHI
HOPKINS® Telescopes and Accessories

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

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

7220 AA/BA
HOPKINS® Straight Forward Telescope 0°,
enlarged view, diameter 3 mm, length 14 cm, autoclavable,
fiber optic light transmission incorporated,
color code: green

7220 BA/BA
HOPKINS® Forward-Oblique Telescope 30°,
enlarged view, diameter 3 mm, length 14 cm, autoclavable,
fiber optic light transmission incorporated,
color code: red

152201 WAGENER Ear Hook, ball end, size 1, length 15.5 cm
152202 Same, size 2
152203 Same, size 3
152301 Ear Hook, without ball end, size 1, length 15.5 cm
152302 Same, size 2
204250 FISCH Adaptor, for Suction Tubes 204352 – 204354,
with long thumb grip, cut-off hole diameter 1 mm,
inner diameter 1.7 mm, LUER cone, length 5.5 cm

204005 Suction Cannula, angular, LUER-Lock,
outer diameter 0.5 mm, working length 6 cm
204007 Same, outer diameter 0.7 mm
204008 Same, outer diameter 0.8 mm
204010 Same, outer diameter 1 mm
204013 Same, outer diameter 1.3 mm
204015 Same, outer diameter 1.5 mm
204020 Same, outer diameter 2 mm
204025 Same, outer diameter 2.5 mm
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<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>221100</td>
<td>HARTMANN <em>Ear Forceps</em>, extra delicate, serrated, 1 x 4.5 mm, working length 8 cm</td>
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<td>221150</td>
<td><em>Same</em>, working length 12.5 cm</td>
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<tr>
<td>221210</td>
<td>FISCH <em>Ear Forceps</em>, extra delicate, pointed, smooth, 1 x 4.5 mm, working length 8 cm</td>
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<tr>
<td>221201</td>
<td>FISCH <em>Ear Forceps</em>, extra delicate, serrated, 0.4 x 3.5 mm, working length 8 cm</td>
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<td>221304</td>
<td><em>Ear Forceps</em>, extra delicate, serrated, curved to right, working length 8 cm</td>
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<tr>
<td>221305</td>
<td><em>Same</em>, curved to left</td>
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<td>221307</td>
<td><em>Same</em>, curved upwards</td>
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<td>221310</td>
<td>THOMASSIN <em>Ear Forceps</em>, very fine, serrated, retrograde backwards curved, working length 8 cm</td>
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<td>162500</td>
<td>STRÜMPEL <em>Ear Forceps</em>, working length 8 cm</td>
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Transcanal Endoscopic Management of Cholesteatoma

- **HOUSE-DIETER Malleus Nipper**, upbiting, working length 8 cm
- **SAME**, downbiting

- **FISCH Ear Forceps**, round cupped jaws, working length 12.5 cm, diameter 3 mm

- **WULLSTEIN Ear Forceps**, extra delicate, oval cupped jaws, curved to right, oval, 0.9 mm, working length 8 cm
- **SAME**, curved to left
- **SAME**, curved upwards
222602 HOUSE-BELLUCCI Scissors, extra delicate, working length 8 cm

222604 R BELLUCCI Scissors, delicate, curved to right, working length 8 cm

222605 L Same, curved to left

152301 Ear Hook, without ball end, size 1, length 15.5 cm

223100 PLESTER Knife, round, vertical, standard size: 3.5 x 2.5 mm, length 16 cm

223101 Same, medium size: 4 x 2 mm

223500 ROSEN Elevator, tip angled 15°, 12 mm long, width 1.5 mm, length 16 cm

223890 Seeker, extra delicate, angled 25°, with ball end diameter 0.6 mm, length 16 cm
224001  
HOUSE Curette, large, spoon sizes 2 x 3.2 mm and 1.6 x 2.6 mm, length 15 cm

224002  
Same, small, spoon sizes 1 x 1.6 mm and 1.3 x 2 mm

224003  
Same, medium, spoon sizes 1 x 1.8 mm and 2 x 2.8 mm

224005  
HOUSE Curette, angular, extra small, spoon sizes 0.6 x 0.8 mm and 0.8 x 1 mm, length 17 cm

224011  
HOUSE Curette, straight, extra large, spoon sizes 2.3 x 3.5 mm and 2.7 x 4.3 mm, length 15 cm

224301  
WULLSTEIN Needle, strong long curve, length 16.5 cm

224302  
Same, medium curve

224303  
Same, slight curve

226211  
THOMASSIN Dissector, double-ended, distal tips with single curve to right or to left, length 18 cm

226212  
Same, distal tips with double curve to right or to left

226815  
Round Knife 45°, diameter 1.5 mm, length 16 cm

226825  
Same, diameter 2.5 mm

226835  
Same, diameter 3.5 mm
**UNIDRIVE® S III ENT SCB/UNIDRIVE® S III ECO**

The multifunctional unit for ENT

<table>
<thead>
<tr>
<th>Special Features</th>
<th>UNIDRIVE® S III ENT SCB</th>
<th>UNIDRIVE® S III ECO</th>
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<tr>
<td>Touch Screen: Straightforward function selection via touch screen</td>
<td>●</td>
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<td>Set values of the last session are stored</td>
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<td>●</td>
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<tr>
<td>Optimized user control due to touch screen</td>
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<tr>
<td>Choice of user languages</td>
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<tr>
<td>Operating elements are single and clear to read due to color display</td>
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<tr>
<td>One unit – multifunction:</td>
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<tr>
<td>– Shaver system for surgery of the paranasal sinuses and anterior skull base</td>
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<tr>
<td>– INTRA Drill Handpieces (40,000 rpm and 80,000 rpm)</td>
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<td>●</td>
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<tr>
<td>– Sinus Shaver</td>
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<tr>
<td>– Micro Saw</td>
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<tr>
<td>– Dermatome</td>
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<tr>
<td>– High-Speed Handpieces (60,000 rpm and 100,000 rpm)</td>
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<td>Two motor outputs: Two motor outputs enable simultaneous connection of two motors:</td>
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<td>For example, a shaver and micro motor</td>
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<td>Soft start function</td>
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<td>Textual error messages</td>
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<td>Integrated irrigation and coolant pump:</td>
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<tr>
<td>– Absolutely homogeneous, micro-processor controlled irrigation rate throughout</td>
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<tr>
<td>the entire irrigation range</td>
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<td>– Quick and easy connection of the tubing set</td>
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<td>Easy program selection via automated motor recognition</td>
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<td>Continuously adjustable revolution range</td>
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<td>Maximum number of revolutions and motor torque: Microprocessor-controlled motor</td>
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<tr>
<td>rotation speed. Therefore the preselected parameters are maintained throughout</td>
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<tr>
<td>the drilling procedure</td>
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### Motor Systems

#### Specifications

**System specifications**

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<td>10,000*</td>
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<tr>
<td>with Handpiece:</td>
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<td>10,000*</td>
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<tr>
<td>DrillCut-X® II Shaver Handpiece</td>
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<tr>
<td>DrillCut-X® II N Shaver Handpiece</td>
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<td><strong>Sinus burr mode</strong></td>
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<td>Max. rev. (rpm):</td>
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<td>Handpiece:</td>
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<td><strong>High-speed drilling mode</strong></td>
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<td>Max. rev. (rpm):</td>
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<tr>
<td>Counter clockwise or</td>
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<td>60,000/100,000</td>
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<td>clockwise in conjunction</td>
<td>20 7120 50</td>
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<tr>
<td>with High-Speed Micro Motor</td>
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<td><strong>Drilling mode</strong></td>
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<td>Counterclockwise or</td>
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<tr>
<td>micro motor and connecting</td>
<td>20 7111 73</td>
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<tr>
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<td><strong>Micro saw mode</strong></td>
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<td>Max. rev. (rpm):</td>
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<td>cable</td>
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<td><strong>Dermatome mode</strong></td>
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<td>Max. rev. (rpm):</td>
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<td>8,000</td>
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<td>micro motor and connecting</td>
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<tr>
<td>cable</td>
<td>20 7111 73</td>
<td></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.*

### Touch Screen

**UNIDRIVE® S III ENT SCB**

- **Touch Screen:** 6.4" / 300 cd/m²
- **Weight:** 5.2 kg
- **Certified to:** IEC 601-1 CE acc. to MDD
- **Available languages:** English, French, German, Spanish, Italian, Portuguese, Greek, Turkish, Polish, Russian

**UNIDRIVE® S III ECO**

- **Weight:** 4.7 kg
- **Certified to:** IEC 60601-1
- **Available languages:** numerical codes
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

<table>
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<tr>
<th>20711033</th>
<th>High-Performance EC Micro Motor II, for use with UNIDRIVE® II/UNIDRIVE® ENT/OMFS/NEURO/ECO and Connecting Cable 20711073, or for use with UNIDRIVE® S III ENT/ECO/NEURO and Connecting Cable 20711173</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>20711173</th>
<th>Connecting Cable, to connect High-Performance EC Micro Motor 20711033 to UNIDRIVE® S III ENT/ECO/NEURO</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th>20712033</th>
<th>High-Speed Micro-Motor, max. speed 60,000 rpm, including connecting cable, for use with UNIDRIVE® S III ENT/NEURO</th>
</tr>
</thead>
</table>

- 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 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
Clip Set, for use with silicone tubing set
SCB Connecting Cable, length 100 cm
Single Use Tubing Set*, sterile, package of 3

UNIDRIVE® S III ECO

40 7014 20

UNIDRIVE® S III ECO, motor control unit with two motor outputs and integrated irrigation pump, power supply 100 – 240 VAC, 50/60 Hz
including:
Mains Cord
Two-Pedal Footswitch, two-stage, with proportional function
Clip Set, for use with silicone tubing set
Single Use Tubing Set*, sterile, package of 3

Specifications:

<table>
<thead>
<tr>
<th>Touch Screen</th>
<th>UNIDRIVE® S III ENT SCB: 6,4”/300 cd/m²</th>
<th>Dimensions w x h x d</th>
<th>300 x 165 x 265 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>9 steps</td>
<td>Weight</td>
<td>5.2 kg</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–240 VAC, 50/60 Hz</td>
<td>Certified to</td>
<td>EC 601-1, CE acc. to MDD</td>
</tr>
</tbody>
</table>

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

UNIT SIDE

PATIENT SIDE

Two-Pedal Footswitch

High-speed Handpieces

INTRA Drill Handpieces

Micro Saw

Dermatome

High-Speed Micro Motor

High-speed EC Micro Motor II

High-Speed EC Micro Motor II

Dermatome

20016630

20712033

20711033

20711173

252660 – 252692

252575 – 252590

254000 – 254300

253000 – 253300

Single Use Tubing Set

Two-Pedal Footswitch

High-speed Micro Motor

High-speed EC Micro Motor II

High-Speed Handpieces

INTRA Drill Handpieces

Micro Saw

Dermatome

20016630

20712033

20711033

20711173

252660 – 252692

252575 – 252590

254000 – 254300

253000 – 253300

031131-10

031131-10
Optional Accessories
for UNIDRIVE® S III ENT SCB and UNIDRIVE® S III ECO

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>280053</td>
<td><strong>Universal Spray</strong>, 6x 500 ml bottles – HAZARDOUS GOODS – UN 1950 including:</td>
</tr>
<tr>
<td></td>
<td><strong>Spray Nozzle</strong></td>
</tr>
<tr>
<td>280053 C</td>
<td><strong>Spray Nozzle</strong>, for the reprocessing of INTRA burr handpieces,</td>
</tr>
<tr>
<td></td>
<td>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>
</tr>
</tbody>
</table>

*mtp medical technical promotion gmbh, Take-Off GewerbePark 46, 78579 Neuhausen ob Eck, Germany*
INTRA Drill Handpieces
for Ear Micro Surgery

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

252570

INTRA Drill Handpiece, angled, length 12.5 cm, transmission 1:1 (40,000 rpm), for use with KARL STORZ high-performance EC micro motor II and straight shaft burrs

252573

INTRA Drill Handpiece, angled, length 12.5 cm, transmission 1:2 (80,000 rpm), for use with KARL STORZ high-performance EC micro motor II and straight shaft burrs

252590

INTRA Drill Handpiece, straight, length 11 cm, transmission 1:1 (40,000 rpm), for use with KARL STORZ high-performance EC micro motor II and straight shaft burrs
Burrs

Straight Shaft Burrs, length 7 cm, for use with INTRA Drill Handpieces 252590, 252570, 252573

<table>
<thead>
<tr>
<th>Detail</th>
<th>Size</th>
<th>Dia. mm</th>
<th>Standard</th>
<th>Tungsten Carbide</th>
<th>Transverse Tungsten Carbide</th>
<th>Diamant</th>
<th>Diamond, coarse</th>
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<tbody>
<tr>
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<td>0.6</td>
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<td>261006</td>
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<td>262006</td>
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<td>261018</td>
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<td>262018</td>
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<td>261023</td>
<td>261123</td>
<td>262023</td>
<td>262223</td>
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<td>260070</td>
<td>261070</td>
<td>–</td>
<td>262070</td>
<td>262270</td>
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</tr>
</tbody>
</table>

260000 **Standard Straight Shaft Burr**, stainless, sizes 006 – 070, length 7 cm, set of 15
261000 **Tungsten Carbide Straight Shaft Burr**, stainless, sizes 006 – 070, length 7 cm, set of 15
261100 **Tungsten Carbide Straight Shaft Burr**, with cross cut, stainless, sizes 014 – 060, length 7 cm, set of 6
262000 **Diamond Straight Shaft Burr**, stainless, sizes 006 – 070, length 7 cm, set of 15
262200 **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 7 cm, set of 9, color code: gold
Transcanal Endoscopic Management of Cholesteatoma

Burrs

Straight Shaft Burrs, length 5.7 cm, for use with INTRA Drill Handpieces 252590, 252570, 252573

<table>
<thead>
<tr>
<th>Detail</th>
<th>Size</th>
<th>Dia. mm</th>
<th>Standard</th>
<th>Tungsten Carbide</th>
<th>Transverse Tungsten Carbide</th>
<th>Diamond</th>
<th>Diamond, coarse</th>
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<tbody>
<tr>
<td></td>
<td>014</td>
<td>1.4</td>
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<td>649614 HK</td>
<td>649614 Q</td>
<td>649714 K</td>
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<td>018</td>
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<td>649618 K</td>
<td>649618 HK</td>
<td>–</td>
<td>649718 K</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>023</td>
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<td>649623 K</td>
<td>649623 HK</td>
<td>649623 Q</td>
<td>649723 K</td>
<td>649723 GK</td>
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<td>649627 K</td>
<td>649627 HK</td>
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<td>649727 K</td>
<td>649727 GK</td>
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<td>649731 K</td>
<td>649731 GK</td>
</tr>
<tr>
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<td>035</td>
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<td>649635 HK</td>
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<td>649735 GK</td>
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<td>649640 HK</td>
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<td>649745 GK</td>
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<td>649750 GK</td>
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<td>649660 HK</td>
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<td>649760 K</td>
<td>649760 GK</td>
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<tr>
<td></td>
<td>070</td>
<td>7</td>
<td>649670 K</td>
<td>649670 HK</td>
<td>–</td>
<td>649770 K</td>
<td>649770 GK</td>
</tr>
</tbody>
</table>

649600 K  **Standard Straight Shaft Burr**, stainless, sizes 014 – 070, length 5.7 cm, set of 11

649600 HK **Tungsten Carbide Straight Shaft Burr**, stainless, sizes 014 – 070, length 5.7 cm, set of 11

649700 K  **Diamond Straight Shaft Burr**, stainless, sizes 014 – 070, length 5.7 cm, set of 11

649700 GK **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 5.7 cm, set of 9, color code: gold

Straight Shaft Burrs, cylindrical, barrel-shaped, and bud-shaped

<table>
<thead>
<tr>
<th>Size</th>
<th>Dia. mm</th>
<th>cylindrical</th>
<th>barrel-shaped</th>
<th>bud-shaped</th>
<th>length 7 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>020</td>
<td>2</td>
<td>–</td>
<td>262560</td>
<td>–</td>
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<tr>
<td>040</td>
<td>4</td>
<td>–</td>
<td>262561</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>050</td>
<td>5</td>
<td>265050</td>
<td>–</td>
<td>263050</td>
<td></td>
</tr>
<tr>
<td>060</td>
<td>6</td>
<td>265060</td>
<td>–</td>
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<td></td>
</tr>
<tr>
<td>070</td>
<td>7</td>
<td>265070</td>
<td>–</td>
<td>263070</td>
<td></td>
</tr>
</tbody>
</table>
Burrs and Accessories

LINDEMANN Burrs, conical, stainless, length 7 cm

<table>
<thead>
<tr>
<th>Size</th>
<th>Diameter mm</th>
<th>Conical sterilizable</th>
</tr>
</thead>
<tbody>
<tr>
<td>018</td>
<td>1.8</td>
<td>263518</td>
</tr>
<tr>
<td>021</td>
<td>2.1</td>
<td>263521</td>
</tr>
<tr>
<td>023</td>
<td>2.3</td>
<td>263523</td>
</tr>
</tbody>
</table>

Burrs Accessories

280090  Size Template, for drills, stainless steel, sterilizable
280080  Brush, for cleaning atraumatic jaws, sterilizable, package of 5
280120  Temporal Bone Holder, bowl-shaped, with 3 fixation screws for tensioning the petrosal bone and with evacuation tube for irrigation liquid
**Accessories for Burrs**

- **280030** Rack, for 36 straight shaft burrs with a length of 7 cm, foldable, sterilizable, size 22 x 11.5 x 2 cm
- **280030 K** Metal Bar, for fixation at Rack 280030, to hold 18 burrs with a length of 7 cm and 16 burrs with a length of 5.7 cm, size 16 x 2.5 x 1 cm
- **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 280035** Rack, for 54 straight shaft burrs with a length of 5 cm (36 pieces) and 7 cm (18 pieces), foldable, sterilizable, size 22 x 12.5 x 3 cm
- **NEW 280040** Rack, flat model, to hold 21 straight shaft burrs with a length of up to 6 cm (6 pcs) and 7 cm (15 pcs), folding model, sterilizable, size 17.5 x 9.5 x 1.2 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 rack.
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 trays.
UNIDRIVE® S III ENT SCB
High-Speed Handpieces, angled, 100,000 rpm

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

100,000 rpm
diameter 7.5 mm

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

252681 High-Speed Handpiece, medium, angled, 100,000 rpm,
for use with High-Speed Micro-Motor 20712033
UNIDRIVE® S III ENT SCB
High-Speed Handpieces, angled and straight, 60,000 rpm

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

252660  High-Speed Handpiece, extra short, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20712033

252661  High-Speed Handpiece, short, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20712033

252690  High-Speed Handpiece, extra short, straight, 60,000 rpm, for use with High-Speed Micro-Motor 20712033

252691  High-Speed Handpiece, short, straight, 60,000 rpm, for use with High-Speed Micro-Motor 20712033
### UNIDRIVE® S III ENT SCB
High-Speed Standard Burrs, High-Speed Diamond Burrs

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

<table>
<thead>
<tr>
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<th>short</th>
<th>medium</th>
</tr>
</thead>
<tbody>
<tr>
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<td>350110 S</td>
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<td>350130 M</td>
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<td>350140 M</td>
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<td>350150 M</td>
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<td>350160 M</td>
</tr>
<tr>
<td>7</td>
<td>350170 S</td>
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</table>

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

<table>
<thead>
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<td>350210 M</td>
</tr>
<tr>
<td>2</td>
<td>350220 S</td>
<td>350220 M</td>
</tr>
<tr>
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<td>350230 M</td>
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<td>350260 M</td>
</tr>
<tr>
<td>7</td>
<td>350270 S</td>
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</table>
## UNIDRIVE® S III ENT SCB

**High-Speed Diamond Burrs, High-Speed Acorns, High-Speed Barrel Burrs, High-Speed Neuro Fluted Burr**

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

![High-Speed Diamond Burrs, High-Speed Acorns, High-Speed Barrel Burrs, High-Speed Neuro Fluted Burr](image)

<table>
<thead>
<tr>
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<th>Short</th>
<th>Medium</th>
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<tbody>
<tr>
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<td>350360 M</td>
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<table>
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<table>
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<tr>
<td>3</td>
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</table>
UNIDRIVE® S III ENT SCB
High-Speed Standard Burrs, High-Speed Diamond Burrs

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

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>extra short</th>
<th>short</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>330110 ES</td>
<td>330110 S</td>
</tr>
<tr>
<td>2</td>
<td>330120 ES</td>
<td>330120 S</td>
</tr>
<tr>
<td>3</td>
<td>330130 ES</td>
<td>330130 S</td>
</tr>
<tr>
<td>4</td>
<td>330140 ES</td>
<td>330140 S</td>
</tr>
<tr>
<td>5</td>
<td>330150 ES</td>
<td>330150 S</td>
</tr>
<tr>
<td>6</td>
<td>330160 ES</td>
<td>330160 S</td>
</tr>
<tr>
<td>7</td>
<td>330170 ES</td>
<td>330170 S</td>
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<table>
<thead>
<tr>
<th>Diameter in mm</th>
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<tbody>
<tr>
<td>0.6</td>
<td>330206 ES</td>
<td>330206 S</td>
</tr>
<tr>
<td>1</td>
<td>330210 ES</td>
<td>330210 S</td>
</tr>
<tr>
<td>1.5</td>
<td>330215 ES</td>
<td>330215 S</td>
</tr>
<tr>
<td>2</td>
<td>330220 ES</td>
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<tr>
<td>3</td>
<td>330230 ES</td>
<td>330230 S</td>
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<tr>
<td>4</td>
<td>330240 ES</td>
<td>330240 S</td>
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<td>5</td>
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<td>6</td>
<td>330260 ES</td>
<td>330260 S</td>
</tr>
<tr>
<td>7</td>
<td>330270 ES</td>
<td>330270 S</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

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>extra short</th>
<th>short</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>330330 ES</td>
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</tr>
<tr>
<td>4</td>
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<td>330340 S</td>
</tr>
<tr>
<td>5</td>
<td>330350 ES</td>
<td>330350 S</td>
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<tr>
<td>6</td>
<td>330360 ES</td>
<td>330360 S</td>
</tr>
<tr>
<td>7</td>
<td>330370 ES</td>
<td>330370 S</td>
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<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>extra short</th>
<th>short</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>330440 ES</td>
<td>330440 S</td>
</tr>
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<td>6</td>
<td>330460 ES</td>
<td>330460 S</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Size in mm (diameter x length)</th>
<th>extra short</th>
<th>short</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter 2.1/11</td>
<td>330511 ES</td>
<td>330511 S</td>
</tr>
<tr>
<td>Diameter 2.3/26</td>
<td>330526 ES</td>
<td>330526 S</td>
</tr>
</tbody>
</table>
Oscillating Micro Saws

![Oscillating Micro Saw](image)

254000 Oscillating Micro Saw, inbuilt irrigation tube, max. recommended number of revolutions 15,000 rpm corresponds to 15,000 oscillations/min., without saw blades, with fork wrench

**Saw blades, short shaft, for use with 254000**

254024 Saw Blade, short shaft, blade thickness 0.3 mm, width of blade 6 mm, working length 11 mm, package of 1, for use with 254000

254025 Same, width of blade 10 mm

254026 Same, width of blade 15 mm

254030 Same, blade thickness 0.15 mm, width of blade 6 mm

**Saw blades, long shaft, for use with 254000**

254027 Saw Blade, long shaft, blade thickness 0.3 mm, width of blade 6 mm, working length 26 mm, package of 1, for use with 254000

254028 Same, width of blade 10 mm

254029 Same, width of blade 15 mm

254031 Same, blade thickness 0.15 mm, width of blade 6 mm
Micro Compass Saws, Osseo Scalpel

254100  **Micro Sagittal Saw**, without saw blades, integrated irrigation tube, with fork wrench, recommended maximum speed: 20,000 rpm

**Saw blades, for use with 254100**

- 254170  **Saw Blade**, blade thickness 0.35 mm, width of blade 4 mm, working length 10 mm, package of 12, for use with Micro Sagittal Saw 254100
- 254171  *Same*, width of blade 6 mm, working length 10 mm
- 254172  *Same*, width of blade 6 mm, working length 15 mm
- 254173  *Same*, width of blade 10 mm, working length 15 mm
- 254174  *Same*, width of blade 12 mm, working length 27 mm
- 254175  *Same*, width of blade 6 mm, working length 10 mm

254200  **Osseo Scalpel, Micro Saw**, with axial/sagittal channel, pendulum stroke, especially appropriate for 3-dimensional incision guiding, without saw blades, inbuilt irrigation tube, max. recommended number of revolution 20,000 rpm, with fork wrench

**Saw blades, for use with 254200**

- 254235  **Saw Blade**, blade thickness 0.35 mm, working length 12 mm, package of 12, for use with Osseo Scalpel, Micro Saw 254200
- 254236  *Same*, working length 18 mm
- 254237  *Same*, working length 24 mm
Micro Compass Saws

254300  **Micro Compass Saw**, without saw blades, detachable irrigation tube, with fork wrench, recommended maximum speed: 15,000 rpm

Saw blades, for use with 254300

254312  **Saw Blade**, blade thickness 0.25 mm, working length 11 mm, package of 12, for use with 254300

254313  **Same**, working length 14 mm

254314  **Same**, working length 18 mm

254315  **Same**, working length 22 mm

254316  **Same**, working length 26 mm
Micro Saws – Accessories

39553 A Sterilizing and Storage Basket, provides safe storage of accessories for the KARL STORZ micro saw system during cleaning and sterilization, includes basket for small parts

for storage of:
– Up to 6 saw handpieces
– Connecting cable
– EC micro motor
– Saw blades
Dermatomes

Special features:

- For removing skin and mucosa
- Dermaplaning for obtaining small pieces of skin from behind the ear
- Can be easily adapted to motor
- Optimal setting of the incision depth
- Lightweight construction

253000 Dermatome, with INTRA coupling, width of incision 12 mm, max. number of rev. 8000 rpm

253001 Replacement Blades, for dermatome 253000, width of incision 12 mm, non-sterile, package of 10

253100 Dermatome, with INTRA coupling, width of incision 25 mm, max. number of rev. 8000 rpm

253101 Replacement Blades, for dermatome 253100, width of incision 25 mm, non-sterile, package of 10

253200 Dermatome, with INTRA coupling, width of incision 50 mm, max. number of rev. 8000 rpm

253201 Replacement Blades, for dermatome 253200, width of cut 50 mm, non-sterile, package of 10

253300 Dermatome, with INTRA coupling, width of incision 75 mm, max. number of rev. 8000 rpm

253301 Replacement Blades, for dermatome 253300, width of incision 75 mm, non-sterile, package of 10
Dermatome – Accessories

39554 A **Sterilizing and Storage Basket**, provides safe storage of accessories for the **KARL STORZ** dermatome system during cleaning and sterilization

**for storage of:**
- Up to 2 dermatomes
- Connecting cable
- EC micro motor with INTRA coupling
### 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](image1.png)

![Live menu](image2.png)

![Intelligent icons](image3.png)

![Side-by-side view](image4.png)
**IMAGE1 S Camera System**

**NEW**

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

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

**FULL HD image**

**CLARA**

**FULL HD image**

**CHROMA**

**FULL HD image**

**SPECTRA A**

**FULL HD image**

**SPECTRA B**

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

**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:**

<table>
<thead>
<tr>
<th>Specification</th>
<th>TC 200EN</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD video outputs</td>
<td>- 2x DVI-D</td>
</tr>
<tr>
<td></td>
<td>- 1x 3G-SDI</td>
</tr>
<tr>
<td>Format signal outputs</td>
<td>1920 x 1080p, 50/60 Hz</td>
</tr>
<tr>
<td>LINK video inputs</td>
<td>3x</td>
</tr>
<tr>
<td>USB interface</td>
<td>4x USB, (2x front, 2x rear)</td>
</tr>
<tr>
<td>SCB interface</td>
<td>2x 6-pin mini-DIN</td>
</tr>
</tbody>
</table>

| 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**

**IMAGE1 S Connect Module TC 200EN**

**TC 300**

**TC 300** Image1 S H3-Link, link module, for use with IMAGE1 FULL HD three-chip camera heads, power supply 100–120 VAC/200–240 VAC, 50/60 Hz,

*for use with IMAGE1 S Connect TC 200EN*

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

**Specifications:**

<table>
<thead>
<tr>
<th>Specification</th>
<th>TC 300 (H3-Link)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported camera heads/video endoscopes</td>
<td>TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S)</td>
</tr>
<tr>
<td>LINK video outputs</td>
<td>1x</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–120 VAC/200–240 VAC</td>
</tr>
<tr>
<td>Power frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Protection class</td>
<td>I, CF-Defib</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>305 x 54 x 320 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1.86 kg</td>
</tr>
</tbody>
</table>

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

**NEW**

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

![TH 100](image)

**TH 100**  
**IMAGE1 S H3-Z Three-Chip FULL HD Camera Head**,  
50/60 Hz, IMAGE1 S compatible, progressive scan,  
soakable, gas- and plasma-sterilizable, with integrated  
Parfocal Zoom Lens, focal length f = 15–31 mm (2x),  
2 freely programmable camera head buttons,  
for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

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

![TH 104](image)

**TH 104**  
**IMAGE1 S H3-ZA Three-Chip FULL HD Camera Head**,  
50/60 Hz, IMAGE1 S compatible, **autoclavable**,  
progressive scan, soakable, gas- and plasma-sterilizable,  
with integrated Parfocal Zoom Lens, focal length f = 15–31 mm (2x),  
2 freely programmable camera head buttons, for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

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

9619 NB

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

9826 NB

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

### KARL STORZ HD and FULL HD Monitors

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

### Inputs:

<table>
<thead>
<tr>
<th>Accessory</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Fibre Optic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3G-SDI</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
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### Outputs:

<table>
<thead>
<tr>
<th>Accessory</th>
<th>19&quot;</th>
<th>26&quot;</th>
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</thead>
<tbody>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>3G-SDI</td>
<td></td>
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</table>

### Signal Format Display:

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>4:3</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>5:4</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>16:9</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Picture-in-Picture</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>PAL/NTSC compatible</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>

### Optional accessories:

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

### Specifications:

<table>
<thead>
<tr>
<th>KARL STORZ HD and FULL HD Monitors</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>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>0−40°C</td>
<td>5−35°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-20−60°C</td>
<td>-20−60°C</td>
</tr>
<tr>
<td>Rel. humidity</td>
<td>max. 85%</td>
<td>max. 85%</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>469.5 x 416 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
</tr>
<tr>
<td>Power supply</td>
<td>100−240 VAC</td>
<td>100−240 VAC</td>
</tr>
<tr>
<td>Certified to</td>
<td>EN 60601-1, protection class IPX0</td>
<td>EN 60601-1, UL 60601-1, MDD93/42/EEC, protection class IPX2</td>
</tr>
</tbody>
</table>
Cold Light Fountains and Accessories

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

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

- **Same**, length 230 cm
  - 495 NTX

**Cold Light Fountain XENON NOVA® 175**

- **20131501** Cold Light Fountain XENON NOVA® 175, power supply: 100–125 VAC/220–240 VAC, 50/60 Hz including:
  - Mains Cord

- **20132026** XENON Spare Lamp, 175 watt, 15 volt

**Cold Light Fountain XENON 300 SCB**

- **20133101-1** Cold Light Fountain XENON 300 SCB with built-in antifog air-pump, and integrated KARL STORZ Communication Bus System SCB
  - power supply: 100–125 VAC/220–240 VAC, 50/60 Hz
  - including:
    - Mains Cord
    - SCB Connecting Cord, length 100 cm

- **20133027** Spare Lamp Module XENON with heat sink, 300 watt, 15 volt

- **20133028** XENON Spare Lamp, only, 300 watt, 15 volt
The name AIDA stands for the comprehensive implementation of all documentation requirements arising in surgical procedures: A tailored solution that flexibly adapts to the needs of every specialty and thereby allows for the greatest degree of customization.

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

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

**WD 200-XX**

**AIDA Documentation System**, for recording still images and videos, dual channel up to FULL HD, 2D/3D, power supply 100-240 VAC, 50/60 Hz

including:
- **USB Silicone Keyboard**, with touchpad
- **ACC Connecting Cable**
- **DVI Connecting Cable**, length 200 cm
- **HDMI-DVI Cable**, length 200 cm
- **Mains Cord**, length 300 cm

**WD 250-XX**

**AIDA Documentation System**, for recording still images and videos, dual channel up to FULL HD, 2D/3D, including **SMARTSCREEN® (touch screen)**, power supply 100-240 VAC, 50/60 Hz

including:
- **USB Silicone Keyboard**, with touchpad
- **ACC Connecting Cable**
- **DVI Connecting Cable**, length 200 cm
- **HDMI-DVI Cable**, length 200 cm
- **Mains Cord**, length 300 cm

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

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

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

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

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

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

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

![Equipment Cart Image]

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

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

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

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

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

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

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