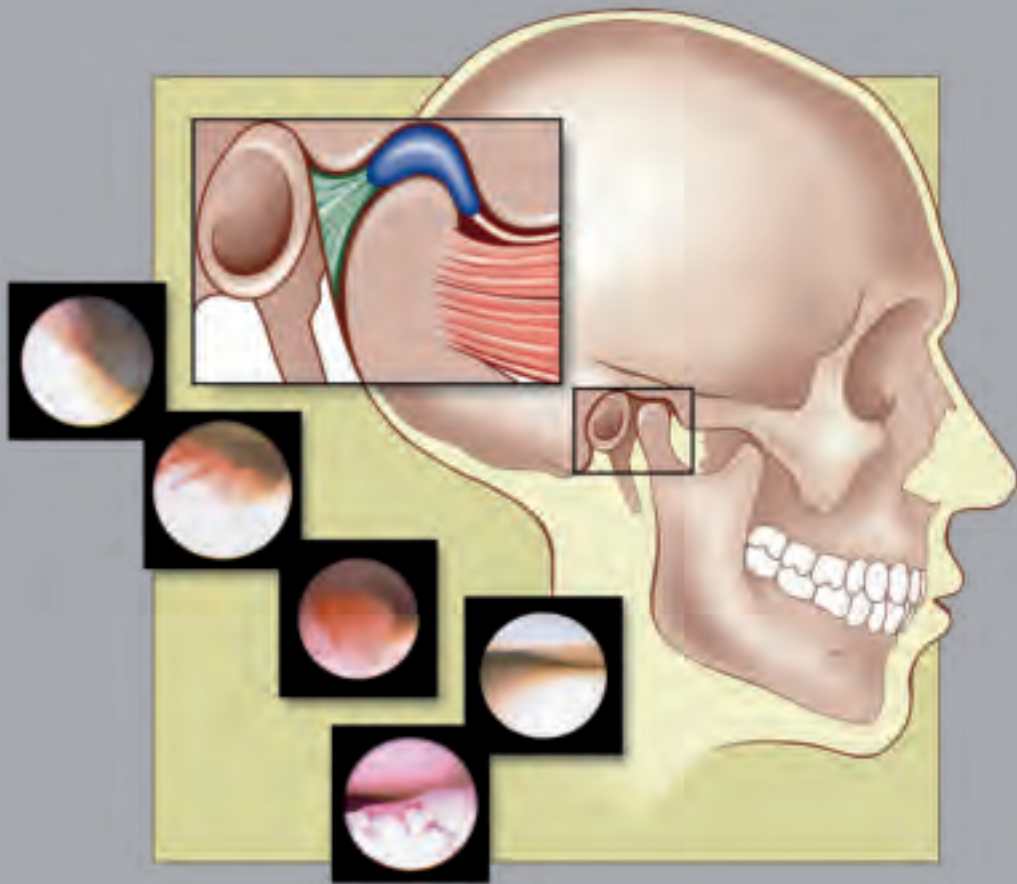


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ARTHROSCOPY OF THE TEMPOROMANDIBULAR JOINT



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Arthroscopy of the Temporomandibular Joint

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1.0 Introduction

The surgical treatment of temporomandibular joint (TMJ) disorders presents us with an extremely complex and complicated set of interwoven problems that can raise difficult issues of diagnosis and treatment.

The great diversity of TMJ disorders results from the overlap between multiple organ systems and numerous functional processes, as illustrated in **Fig. 1**.



The temporomandibular joint and associated disorders.

The following components may also play a role:

- Craniomandibular dysfunction (CMD)
- Cerebral, neurological and psychiatric diseases
- Orthopedic diseases (e.g., of the cervical spine)
- Regulatory dysfunction, overloads, compensatory processes
- Age-related changes
- Decompensation due to changes in activity level or physical situation

Proper patient selection is an essential foundation for successful surgical treatment. The principal indications for TMJ surgery are forms of craniomandibular dysfunction originating in the articular disc and the retrodiscal tissue (known also as the posterior attachment, posterior ligaments, or retrodiscal pad). The literature may be consulted for further details on these conditions.

As in all degenerative muscle, bone and joint diseases, surgical intervention should be elected sparingly and the primary treatment options are conservative. Surgical treatment is indicated in only about 5% of patients with TMJ disorders. Because TMJ operations are such specialized procedures, often it takes years to acquire adequate clinical experience.

Another factor that limits the indications for TMJ surgery is the miniscule size of the joint (about the size of a thumbnail). As a result, TMJ surgery and especially minimally invasive arthroscopic procedures are more technically demanding than procedures in larger joints, which are easier to access and explore. A major obstacle in mastering arthroscopic skills is the fact that operators cannot practice in human patients, while practicing in cadavers may do little to impart clinically relevant skills due to the altered consistency and appearance of the nonperfused tissues.

At our institution in Greifswald, we have solved the problem of safe TMJ arthroscopic training by developing an animal model that enables us to practice and teach a range of minimally invasive arthroscopic procedures in the TMJ. This is such an effective training tool that technical problems which subsequently arise in patients no longer limit the indications for TMJ arthroscopy.

Our objective in creating this guide to TMJ arthroscopy is to convey the experience that we have gained in our training model. Besides the basic principles of diagnostic arthroscopy, particular attention is given to the arthroscopic use of an innovative water-jet scalpel and to other arthroscopic techniques on the TMJ disc and retrodiscal tissue.

The simultaneous use of a surgical navigation system helps the operator to proceed more confidently and will one day make an important contribution to quality assurance in arthroscopic surgery of the TMJ.

In writing this monograph, we hope that we will be able to improve training to such a degree that a greater percentage of patients with TMJ disorders will become candidates for arthroscopic surgery, thus avoiding the large wounds of "open" surgical procedures and perhaps eliminating the risk of facial nerve injury.

2.0 Our Protocol for the Treatment of TMJ Disc Displacements

TMJ disc displacements and elongation of the retrodiscal tissue – referred to in the literature as “internal derangement,” craniomandibular dysfunction, and secondary or functional TMJ disorders (Gernet and Rammelsberg 2002) – account for more than 90% of the TMJ cases that are referred to our center following a trial of conservative therapy. Almost all of these cases involve an anterior disc displacement with elongation of the retrodiscal tissue. Rarely, we may see posterior disc displacement in patients who have prognathic dentition or an habitually protruded jaw posture. It is also rare to encounter lateral disc displacements causing functional problems, and so this booklet deals mainly with anterior disc displacements with associated stretching of the retrodiscal tissue.

Most chronic, non-reducing disc displacements begin as an acute disc displacement. Thus, we repeatedly emphasize the importance of avoiding progression to more advanced stages of anterior disc displacement by initiating adequate treatment while the displacement is still in an acute stage.

With this in mind, we have developed a recommended treatment protocol at our center, which is outlined below. The guiding principle is that withholding treatment or providing conservative treatment for an acute disc displacement is appropriate only as long as the TMJ has not sustained chronic, irreversible damage.

We apply the following protocol in the treatment of acute, non-reducing anterior disc displacements at our center. Note that the primary treatment measures are conservative:

- **Immediate manual reduction** (aided by local anesthesia, intravenous sedation, or general anesthesia with muscle relaxation).
- **Next: 3 months of conservative therapy** (physical therapy, determining and establishing the centric position of the TMJ, splint therapy, pharmacologic therapy).
- **After an unsuccessful 3-month trial of conservative therapy:** reduction under arthroscopic control, arthroscopic shortening of the retrodiscal tissue.
- **Conservative treatment** is continued for up to one year after arthroscopic surgery, including the use of centric splints that protect the TMJ or widen the joint space (e.g., a bite guard that moves the mandible 1.5 – 2 mm forward). Myoarthropathy may be treated if necessary by injecting botulinum toxin into the affected musculature (e.g., the lateral pterygoid muscle).
- **Permanent correction to a centric jaw position** (the painless or least painful position of the mandible) should be considered at this stage as an alternative to life-long splint therapy. Options for permanent correction include orthognathic surgery, prosthetic treatment, and dysgnathic surgery.
- If the TMJ disorder has not improved or is worse by 12 months after the initial arthroscopic procedure, we recommend **further arthroscopic treatment** or even open surgery (e.g., open shortening of the retrodiscal tissue)).

If the TMJ is not permanently corrected to a centric position, it is extremely likely that the TMJ changes will recur and that surgical measures on the disc and retrodiscal tissue will be unsuccessful. We believe that the timely initiation of appropriate treatment can reduce the incidence of serious TMJ disorders.

3.0 Diagnostic Arthroscopy of the Temporomandibular Joint

3.1 Indications and Contraindications

The principal indications for TMJ arthroscopy are functional complaints involving the TMJ in which clinical examination and imaging studies have not furnished a definitive diagnosis or non-invasive treatment modalities have not significantly improved the patient's complaints.

Indications for arthroscopy:

- *Disc displacement*
- *Disc deformity*
- *Intra-articular adhesions*
- *Degenerative arthritis*
- *Osteoarthritis*
- *Chronic forms of arthritis*
- *Post-traumatic changes*
- *Pseudotumors*

Arthroscopy is contraindicated in patients with acute infections, bony ankylosis, risk of tumor dissemination, general medical contraindications, and anatomical contraindications (*Blaustein and Heffez 1990, Murakami 1989, Ihnishi 1990, Reich 1995*). Rigorous patient selection is the key to a successful operation.

3.2 Preoperative Preparations, Draping, and Instrumentation

Aseptic technique is a prime concern in TMJ arthroscopy. The patient should be draped in a manner that provides sterile access to both TMJs and to the puncture sites that will be marked on the skin. The drapes should also allow free access for passive opening and closing of the jaw by the operator. This is best accomplished with a combination of sheets and plastic film drapes (**Fig. 2**).

Prophylaxis of swelling and prophylactic antibiotics are recommended in the perioperative period.

The instrumentation is illustrated and explained in the Appendix.

Initial equipment and supplies needed for diagnostic arthroscopy:

- *Skin marking pen*
- *Ruler for drawing straight lines*
- *Scalpel*
- *Arthroscope sheath and trocar with sharp obturator for creation of the working space / for access to the site of surgery*
- *Prepared irrigation liquid*



2

Draping for TMJ arthroscopy.

3.3 Arthroscopic Approach to the Temporomandibular Joint

The TMJ is approached through two trocars (ports), each 2 mm in diameter. The HOPKINS® telescope (arthroscope) is introduced through one of the two trocars, which also serves as an irrigation port. The irrigation liquid is drained through the second trocar, which also provides access for passing instruments to the operative site.

Technique of TMJ Puncture for Diagnostic Arthroscopy:

After the TMJ region has been palpated and inspected and the position of the condylar head has been determined by passive movement of the TMJ, the trocar sites are marked using the method described by *Blaustain and Heffez (1990)* and *Reich (1995)*.



Planning the trocar sites for TMJ arthroscopy.

- 1 Locate and mark the center of the tragus.
- 2 Locate and mark the lateral canthus of the eye.
- 3 Draw a straight line between the center of the tragus and the lateral canthus.
- 4 Measure and mark a point on the line that is 10 mm from the center of the tragus, and mark a point (A) located 2 mm below it. The trocar with obturator will be inserted at that point, and the obturator will be removed for insertion of the arthroscope.
- 5 Measure and mark a point on the original line that is 20 mm from the center of the tragus. Drop a perpendicular at that point, measure 10 mm down from the line, and mark that point (B). That is the site where the trocar with sharp obturator will be introduced (Fig. 3).

Before inserting the trocars, we palpate the TMJ region and move the joint to confirm that the points have been marked correctly, since some distortion may occur due to shifting of the skin.

Puncturing the Joint:

At **point A (Fig. 3)**: Insert the sharp obturator/trocar assembly to the temporal bone, angling it medially upward. While keeping the obturator tip in contact with the bone, advance it approximately 2.5 cm into the upper joint space, then remove the obturator.

Check the correct placement of the trocar in the joint space by infusing irrigation fluid through the arthroscope sheath (trocar) and passively opening and closing the mandible. If the fluid level in the arthroscope sheath moves with the jaw, this confirms that the trocar is safely in the joint space. Now introduce the arthroscope with attached video camera (remember to perform the white balance!) into the sheath, and connect the irrigation line to the arthroscope sheath.

At **point B (Fig. 3)**: Insert the second sharp obturator at point B with the tip of the obturator angled upward. Direct it toward the tip of the arthroscope trocar and advance it until it is in contact the temporal bone of the glenoid fossa. Keeping the obturator tip in contact with the bone, advance it approximately 2.5 cm into the upper joint space, then remove the obturator.

Check the correct placement of the arthroscope sheath in the joint space by infusing irrigation fluid through the access port and passively opening and closing the mandible. The fluid level in the arthroscope sheath should move with the jaw, confirming that the sheath is correctly positioned in the joint space.

Next open the inflow stopcock on the arthroscope sheath, which is connected to an infusion system. If continuous irrigation is obtained with an inflow pressure of approximately 1000 mm H₂O and there is a good reflux of irrigation liquid through the sheath, an infusion extension tubing can be connected to the arthroscope sheath (to direct the fluid to a collection vessel), and diagnostic arthroscopy may begin.

The outflowing fluid is collected in the vessel and may be discarded or be retained for diagnostic testing. After the operating room lights are turned off, the surgeon proceeds with indirect diagnostic TMJ arthroscopy while watching the video monitor.

Another technique for puncturing the upper joint space is to use a blunt obturator after filling the upper compartment with fluid injected through a hypodermic needle. To avoid injuring the disc and retrodiscal tissue, we track the sharp point along the bone of the glenoid fossa, working our way around the lateral rim of the fossa until we feel the point “fall” into the joint space. Histologic studies in animal models show that a fine scratch in the bone of the lateral glenoid rim will heal completely with no adverse sequelae for the joint.

Since distending the joint space with fluid may sometimes result in a faulty puncture, an alternative method is to pull the lower jaw forward and downward to open up the joint space.

3.4 Instrument Use, Description of Findings and Documentation

First the video camera is rotated to a horizontal position on the arthroscope to ensure proper horizontal alignment of the arthroscopic image.

When a 30°-HOPKINS® forward-oblique telescope is used, the viewing angle can be adjusted by rotating the scope beneath the camera head. The advantage of using a 30° scope is that it provides a larger viewing angle, making it possible to visualize more of the joint. Care is taken to keep the camera aligned in the horizontal

plane. Because working with a 30° scope is somewhat more complicated than working with a 0°-straight-ahead scope, we recommend starting with the 0° scope, which usually gives a satisfactory view (**Figs. 4a, b**).

Anterior-posterior orientation is checked by passively opening and closing the jaw. When the mouth opens, the disc moves anteriorly and the retrodiscal tissue becomes more tense.



After introducing the arthroscope, the surgeon establishes orientation in the TMJ by watching the video monitor while manually opening the patient's mouth.

If a “red-out” occurs during arthroscopy (**Fig. 5**), this means that there is too much blood in the irrigating fluid due to insufficient flow through the joint. The remedy is to check and adjust the fluid inflow and outflow so that adequate joint irrigation is maintained by the system inflow pressure alone. When this has been accomplished, the field should clear and the intra-articular structures should reappear in the image.

At most institutions, the classification of TMJ disc displacements has been based on clinical findings such as incisal edge clearance and the degree of displacement shown by magnetic resonance imaging.

However, experience in surgical patient groups has shown that the preoperative classification often does not correlate with the arthroscopic findings and the pattern of complaints. It seems preferable, therefore, to classify disc displacements on the basis of arthroscopic findings.

The following points should be noted:

- 1 Landmarks are needed for recognizing and classifying disc displacement.
- 2 It should be possible to define and evaluate the landmarks simultaneously in the same arthroscopic field.
- 3 For taking measurements, it would be helpful to project a scale or grid into the arthroscopic image that relates directly or indirectly to actual dimensions.
- 4 Mouth opening should be taken into account, since the displacement depends on the degree of mouth opening. For reproducibility, disc position should always be determined at equal degrees of incisal edge clearance.

Two useful **landmarks** are the usually well-defined junction between the disc and retrodiscal tissue and the most caudal (lowest) point of the articular tubercle.

It is not always possible to define both landmarks simultaneously in the arthroscopic field. But nonvisualization of the junction between the disc and retrodiscal tissue can itself be used as a classification criterion (see below). Based on my research of the literature,



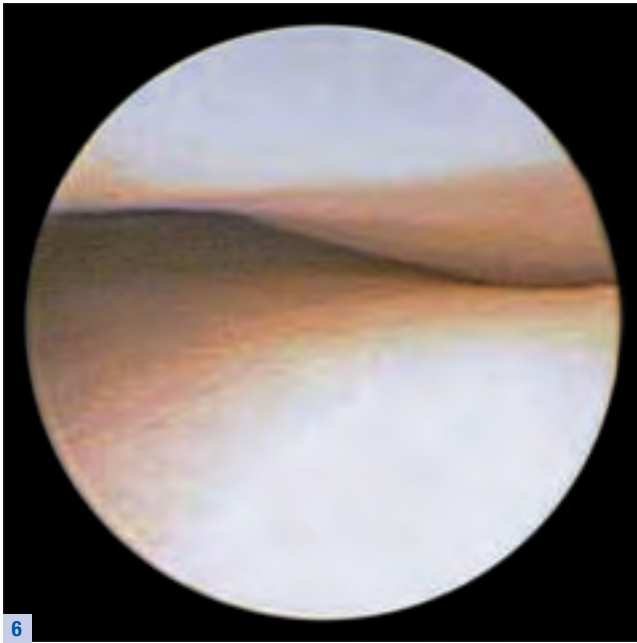
Arthroscopic “red-out” due to insufficient lavage.

the problem of projecting a measurement scale into the arthroscopic image has not yet been solved, and so the arthroscopic classification of disc displacement continues to be a subjective assessment that is not entirely reproducible. Surgical navigation may be the key to eliminating the subjective factor (see Chapter 4.5). The most reproducible way to take into account mouth opening is by classifying the disc displacement in the closed-mouth and maximum open-mouth positions.

Arthroscopy can be used to stage the morphological changes in the TMJ. This is helpful both in making a prognosis and in selecting patients for further treatment.

Arthroscopic staging is based on the degree of disc displacement and the degree of changes in the retrodiscal tissue in relation to the articular tubercle.

As explained below, we classify anterior disc displacements into three stages, each of which has associated therapeutic and prognostic implications.



6

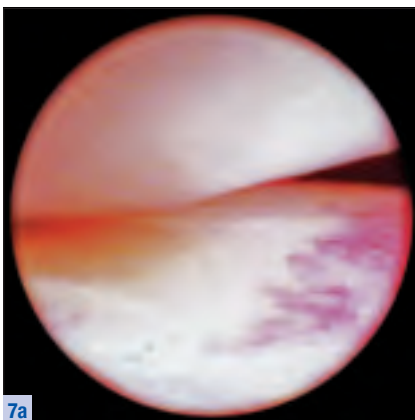
Arthroscopic view of a **stage I** disc displacement.

Classification of disc and retrodiscal changes by TMJ arthroscopy, taking into account the degree of mouth opening (closed-mouth and maximum open-mouth positions):

Stage I anterior disc displacement (Fig. 6): The disc shows a slight degree of anterior displacement (with reduction) when the mouth is closed. At maximum mouth opening the disc is still below the tubercle, and there is little if any limitation of disc gliding (and thus of mouth opening). The retrodiscal tissue is elongated and its function is impaired (see also Fig. 9a).

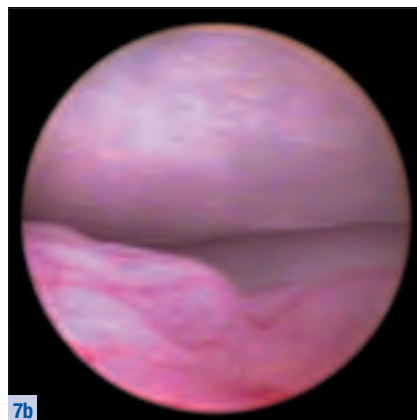
As Fig. 6 illustrates, the two most important regions for evaluating TMJ disease (the retrodiscal region and disc-tubercle region) cannot always be seen in the same image due to the 1.9-mm diameter of the arthroscope. In this case the regions must be evaluated separately and are then correlated to interpret the images.

Stage II anterior disc displacement (Fig. 7): Only a small, posterior portion of the disc is still below the tubercle at maximum mouth opening, and there is significant limitation of disc gliding (and mouth opening). The retrodiscal tissue is moderately elongated and its function is impaired.



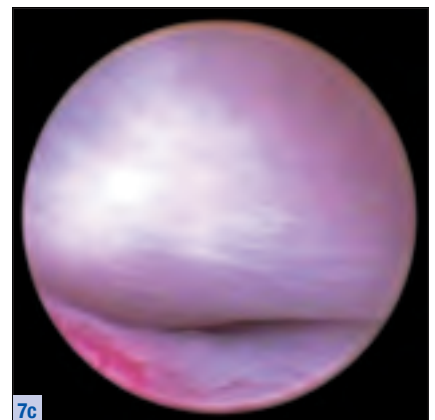
7a

Arthroscopic view of a **stage II** disc displacement. The junction of the disc and retrodiscal tissue is below the tubercle; normally it should lie farther back in the joint.



7b

View of the articular tubercle and underlying disc (a, b).



7c

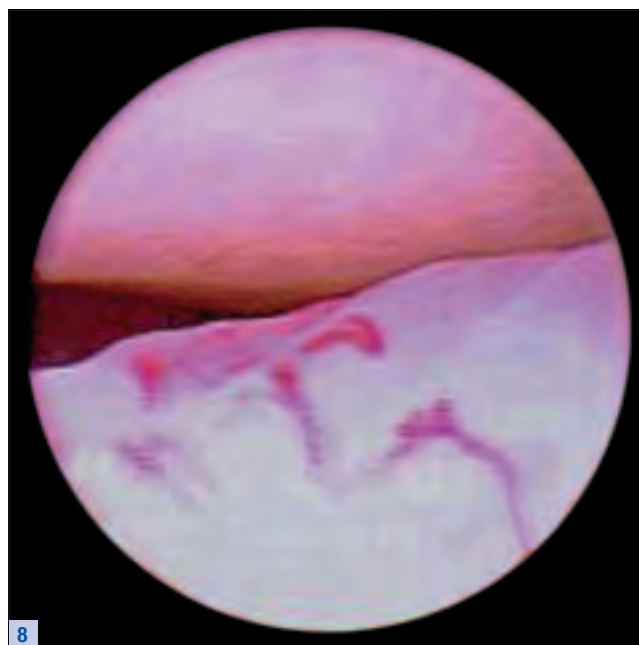
View of the hyperplastic retrodiscal tissue (c).

Stage III anterior disc displacement (Fig. 8): The disc is anterior to the tubercle when the mouth is maximally opened, and there is a complete or almost complete limitation of disc gliding (and mouth opening). The retrodiscal tissue is markedly elongated, and its function is profoundly impaired.

Figure 9a shows various degrees of retrodiscal tissue changes that correlate with the three stages of anterior disc displacement. The stages of disc displacement illustrated by the arthroscopic images in Figs. 6–8 are shown schematically in **Fig. 9b**.

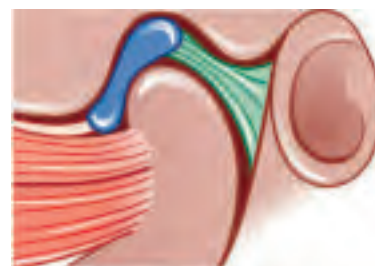
The arthroscopic images should be documented on videotape, video printouts, or digital media for permanent archiving. If desired, the images may be written onto a CD for viewing by the patient or the next attending physician.

Stage I and stage II disc displacements are indications for arthroscopic shortening of the retrodiscal tissue, with a good long-term prognosis. Stage III displacement can be treated arthroscopically with a guarded long-term prognosis, and poor responders can be referred for further surgical treatment.

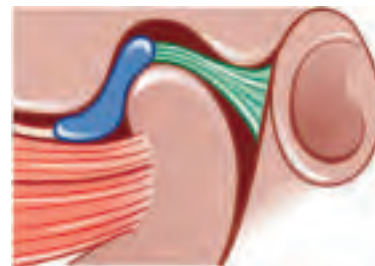


Arthroscopic view of a **stage III** disc displacement. The elongated retrodiscal tissue is below the tubercle, and the disc lies anterior to the condylar head and tubercle.

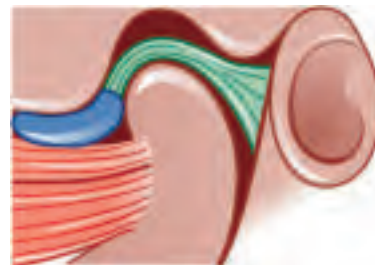
Stage I



Stage II

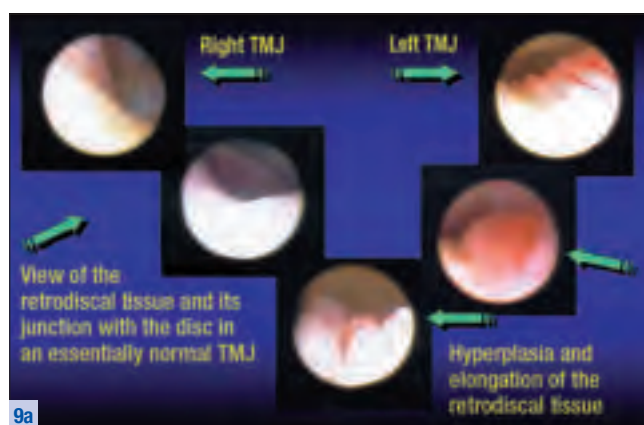


Stage III



9b

Schematic representation of the stages of anterior disc displacement.



Arthroscopic appearance of the retrodiscal tissue and medial articular surface at various stages of disc displacement and associated hyperplasia and elongation of the retrodiscal tissue.

4.0 Minimally Invasive Arthroscopic Treatment of Disk Displacement and Elongation of the Retrodiscal Tissue Combined with Diagnostic Arthroscopy

4.1 Shortening the Retrodiscal Tissue with a Water-Jet Scalpel

TMJ disorders are becoming an increasingly widespread problem in our society. The most common disorders involve an elongation of the retrodiscal tissue combined with anterior disc displacement. Surgical treatment is indicated for particularly severe cases that have not been adequately managed by conservative therapy.

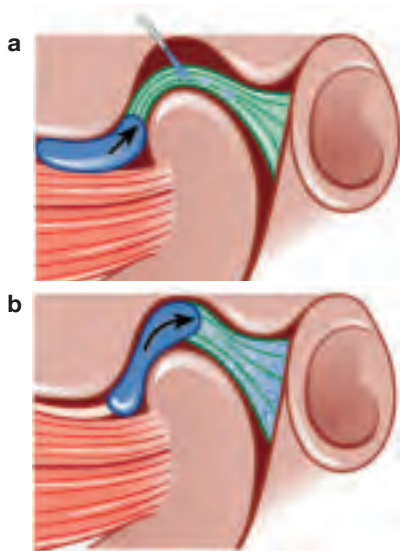
The primary goal of surgical treatment is to improve the function of the retrodiscal ligaments and prevent functionally significant disc displacement.

In an open surgical approach, this is accomplished by excising a portion of the retrodiscal tissue and reapproximating it with sutures to “tie back” the disc. It is desirable to correct the retrodiscal tissue and reduce the articular disc by means of a minimally invasive arthroscopic procedure. Scarring can be induced in the TMJ endoscopically by creating a surgical wound in the retrodiscal tissue. This led to the idea of using a water-jet scalpel arthroscopically to shorten the retrodiscal tissue.

The rationale of this procedure is to shorten and tighten the posterior ligaments as a means of returning the articular disc to its original anatomical position (Kaduk et al. 2005).

While a simple diagnostic arthroscopy without tissue sampling requires only an arthroscope port and a fluid drainage port, retrodiscal surgery additionally requires that a port for operating instruments be placed precisely at the operative site in the TMJ. This **triangulation technique** has a relatively high degree of technical difficulty and takes a considerable amount of practice to learn. In triangulation, the tip of the arthroscope port is placed in the upper joint space so that the working space can be created under arthroscopic guidance via the video monitor. The best point in the retrodiscal tissue for treatment with the water-jet scalpel is the junction between its anterior and middle thirds. When the arthroscope sheath has been placed, the water-jet scalpel is introduced into the operating channel, and that portion of the retrodiscal tissue is treated from medial to lateral at a pressure of 60 bar (Fig. 10). Next the function of the disc and retrodiscal tissue is checked arthroscopically at rest and during passive movement of the lower jaw.

Owing to the excellent biocompatibility of the cutting medium (water), the low degree of tissue necrosis, and the excellent control of the water-jet cutting intensity, which is continuously adjustable from 1 to 150 bar, we prefer the water-jet scalpel marketed by Erbe Elektromedizin, Tübingen, Germany. Another advantage of the variable jet intensity is the ability to apply selective pressure treatment to pain receptors in the retrodiscal tissue (similar to acupuncture). If the dominant symptom is pain, the water-jet treatment will at least interrupt the vicious cycle and improve the patient's complaints.



10

Shortening the retrodiscal tissue with a water-jet scalpel:

- a Locating the retrodiscal tissue,
- b Appearance after treatment with the water-jet scalpel. The water jet causes the retrodiscal tissue to swell, producing an immediate shortening effect. This effect is perpetuated by subsequent scarring of the tissue.

4.2 Aftercare and Complications of Water-Jet Treatment

Key issues following arthroscopy are the correct assessment of findings and the decision-making for further management.

We recommend postoperative immobilization with a head-and-chin dressing for 2 days, a soft diet for 2 weeks, no excessive mouth opening or stresses for 4 weeks, and continued supportive management with splints and physical therapy. Subsequent treatment depends on the course or progression of the disorder (see our treatment protocol for anterior disc displacement in Chapter 2).

Postoperative swelling about the TMJ occasionally leads to obstruction of the Eustachian tube accompanied by transitory hearing impairment.

Pressure on the posterior trocar may cause it to bend backward and damage the external auditory canal. Very rarely, this may cause fractures and fine cracks in the ear canal, similar to those occasionally seen in association with subcapital fractures of the mandibular condyle. These injuries are treated with an antibiotic-impregnated ointment packing until they are completely healed.

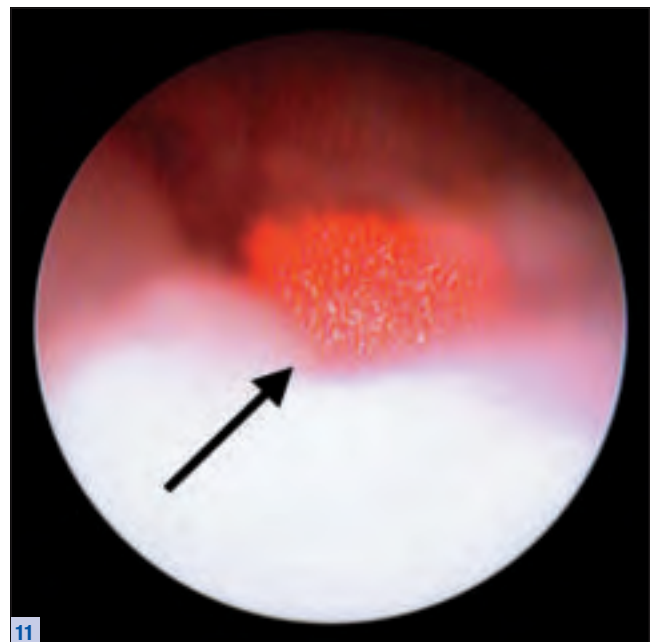
Other complications of arthroscopic surgery have been reported in the literature, but so far we have not encountered them at our institution: penetration of the middle cranial fossa, cerebral injuries, and injuries to the middle ear, inner ear, or facial nerve. All of these potential complications and problems should be disclosed to the patient during the informed consent discussion.

4.3 Other Arthroscopic Treatment Options (Nd:YAG and Holmium:YAG Lasers, Electrosurgery)

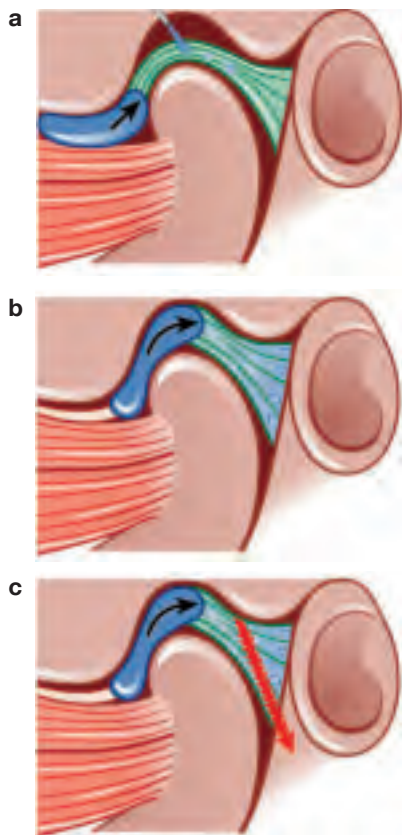
Some authors (*Mosby 1993, Murakami et al. 1996*) state that arthroscopic irrigation alone can produce a permanent therapeutic effect in properly selected patients. Pain relief in these cases is often associated with improved clinical findings such as increased mouth opening, decreased crepitus, or both.

The goal of arthroscopic surgical treatment is to augment or achieve this effect through specific measures in the TMJ.

Besides the water-jet scalpel, a Nd: YAG or holmium: YAG laser can be used to induce scarring and shortening of the retrodiscal tissue (**Fig. 11**). The laser energy is delivered directly to the retrodiscal tissue through an optical fiber passed through the working channel into the TMJ. A similar technique is used with electrosurgical cutting and cautery instruments.



11 Use of the Nd:YAG laser (arrow) in the TMJ.



12

Shortening the retrodiscal tissue with a poly lactide screw. (a, b): Treatment with the water-jet scalpel. (c): Poly lactide screw insertion in the preauricular connective tissue.

4.4 Arthroscopic Fixation Techniques – An Additional Therapeutic Options

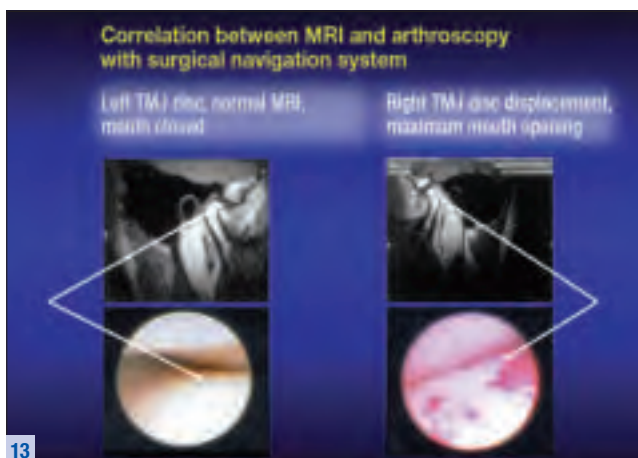
If the water-jet treatment alone is insufficient, the retrodiscal tissue can be fixed with an absorbable poly lactide screw as another alternative to open surgery (Fig. 12). Generally, however, we allow approximately 1 year for the water-jet scar to mature before concluding that it has been unsuccessful and further treatment is needed. Based on our studies in the porcine TMJ, the poly lactide screw induces considerably more scarring in the retrodiscal tissue than the water-jet scalpel alone, without causing other clinically significant side effects (Kaduk et al. 2002). This technique should be reserved for experienced TMJ surgeons, and rigorous patient selection criteria should be applied. Similar techniques are used for arthroscopic surgery of the knee ligaments and menisci, for example.

4.5 TMJ Arthroscopy and Surgical Navigation

At present there are three reasons why a surgical navigation system could contribute to the improvement of arthroscopic surgical technique:

- 1 It allows a more objective arthroscopic diagnosis and improves the correlation between MRI and arthroscopic findings.
- 2 Facilitating the puncture and triangulation technique (see Chapter 4.1).
- 3 It can direct the insertion of poly lactide screws and other arthroscopic fixation devices.

The successful use of a navigation system depends critically on the precision of preoperative imaging and on a precise registration of the patient with navigation software, which currently has an accuracy of ± 1.5 mm.



13

Correlation between MRI and arthroscopy with a surgical navigation system.

5.0 Arthroscopic Training in an Animal Model

In the past, human cadaver studies and visiting physician programs were the only means available for learning arthroscopic surgery in patients. But practice in human cadavers is of limited value due to postmortem tissue changes, which are present even in unfixed specimens. There is little or no opportunity for interpreting arthroscopic findings, evaluating tissue blood flow, or differentiating between normal findings and pathologic changes.

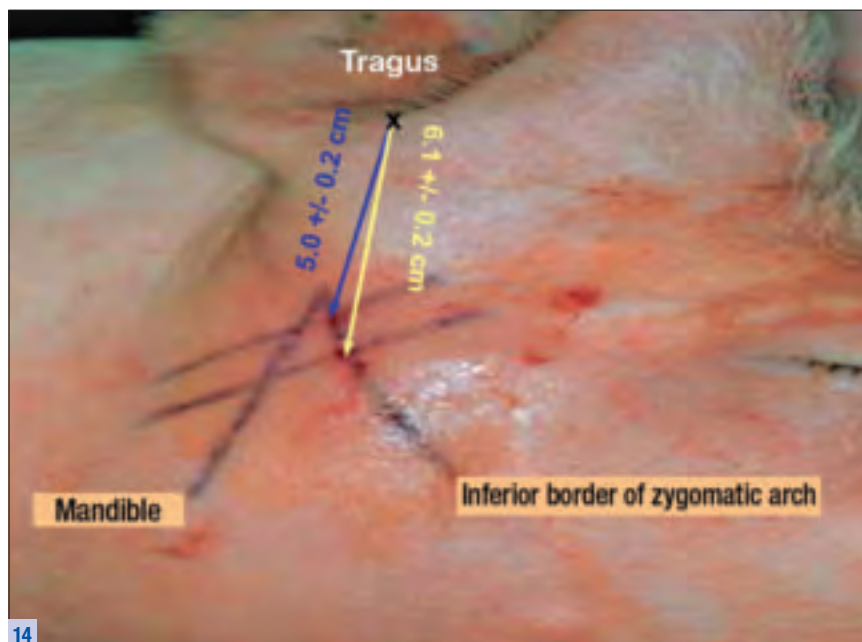
Visiting physician programs are also limited in their ability to provide adequate operating room experience. It is difficult to justify the time-consuming practicing of triangulation techniques and instrument manipulations in actual patients.

I have found that practice in an animal model is essential for acquiring independent arthroscopic operating experience without running the risk of a higher complication rate. Through repeated practice in such a model, the operator will learn to use the arthroscope

so proficiently that he or she can ultimately perform successful arthroscopic surgery in human patients.

A model is also an indispensable tool for the advancement of arthroscopic operating techniques.

In our search for a suitable model for TMJ arthroscopy, we were able to develop a technique in the porcine jaw (Kaduk et al. 2003). We have found that arthroscopic images of the human and porcine TMJ are visually indistinguishable from each other, indicating that this species is an excellent model for arthroscopic exercises and examinations in the TMJ. The only difference between the human and porcine TMJ is the location of the access ports. Once the upper joint space has been entered, there are no appreciable differences between the human TMJ and our animal model. **Figure 14** shows the placement of the trocar sites about the porcine TMJ. All further steps in diagnostic arthroscopy and arthroscopic surgery of the retrodiscal tissue are the same as previously described (see Chapter 3).



Arthroscopic approach to the porcine TMJ (trocar sites have been marked on the skin).

14

6.0 The First Temporomandibular Joint Arthroscope with an Integrated Working Channel – Advantages and New Technical Capabilities

The most difficult and time-consuming step in arthroscopic procedures on the temporomandibular joint (TMJ) is triangulation, i.e., locating the working channel with the endoscope and then navigating both the working channel and arthroscope through the joint space so that surgical actions can be performed in the joint space under endoscopic vision. These actions may include biopsies, the removal of intra-articular loose bodies, endoscopic hydrodissection or laser use (**Figs. 15a, b**), endoscopic suture techniques, and other bimanual arthroscopic procedures within the TMJ.

By interviewing participants at the TMJ arthroscopy workshop held each year at the University of Greifswald, we know that the problem of triangulation is one of the main reasons why the participants do not go on to practice TMJ arthroscopy on their own after completing the workshop.

The new TMJ arthroscope from KARL STORZ solves the triangulation problem by combining the endoscope and working channel in one device. This eliminates the often-tedious process of locating the working channel for a number of applications (**Fig. 15c**).

From a practical standpoint, this means that the operator can look through the arthroscope while simultaneously manipulating instruments through the working channel under arthroscopic guidance. With an outer diameter of 2.3 mm and an integrated working channel of 1.1 mm, the new endoscope conforms to the known anatomic dimensions of the TMJ. The optical fibers that transmit the arthroscopic image are arranged about the circumference of the working channel (**Fig. 15c**).



15a A water-jet scalpel (third generation Hydro-Jet dissector, Erbe, Tübingen, Germany) can be introduced through the integrated working channel of the new arthroscope (KARL STORZ GmbH & Co. KG, Tuttlingen; see **Fig. 15c**).



15b Nd:YAG laser (Martin) with optical fiber beam delivery. The laser fiber can be introduced through the working channel of the new arthroscope.



15c TMJ arthroscope with integrated working channel. Here a water-jet applicator with a 100-micron lumen has been introduced through the working channel for use on the retrodiscal tissue of the TMJ.

The first TMJ arthroscope with an integrated working channel was produced by KARL STORZ in 2009. The system was initially tested in experimental animals under

general anesthesia (Kaduk et al. 2003) with the goal of answering the following questions:

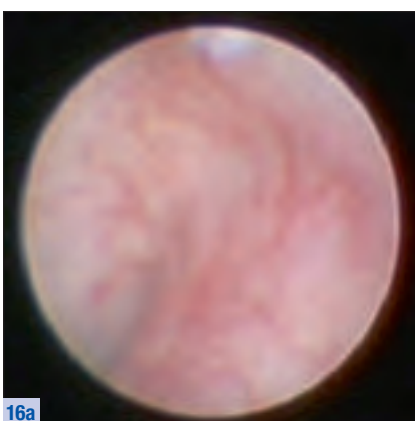
- 1 Is the new arthroscope stable enough to pierce the TMJ capsule and meet the functional requirements of TMJ arthroscopy?
- 2 Is the handling of the arthroscope satisfactory, and is the outer diameter of the endoscope small enough for insertion into the joint?
- 3 Is the endoscopic image resolution or video quality adequate for evaluating the TMJ and guiding instrument use within the joint space?
- 4 Can the integrated irrigation channel provide for continuous irrigation of the joint space?
- 5 Does the integrated working channel of the new TMJ arthroscope allow for the easy, precise handling and guidance of instruments (probe, laser fiber, water-jet scalpel)?
- 6 Can the new endoscope be maneuvered through the joint space by surgical navigation, for example, and are all intra-articular structures accessible via the arthroscope?

The results of the experimental studies have shown that the TMJ arthroscope with integrated working and irrigation channels does have adequate stability, despite the fact that its outer diameter is limited to 2.3 mm by anatomical constraints. Even when piercing the TMJ capsule, the arthroscope showed no instability or other design-related problems. The 2.3-mm outer diameter could enter the joint space as easily as a conventional arthroscope with an outer diameter of 2.0 mm.

Because the arthroscope shaft, with its 2.3-mm diameter, had to accommodate the integrated working channel in addition to optical fibers, the number of optical fibers

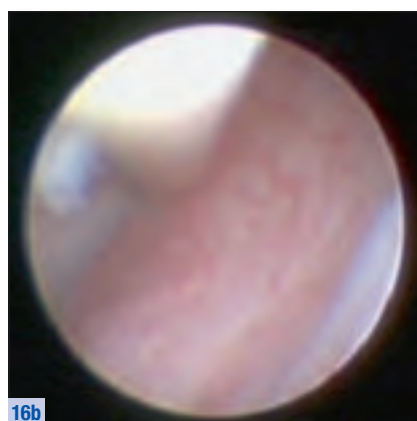
had to be reduced to make room for the extra channel. As a result, the resolution of the new device is less than that of traditional TMJ arthroscopes. The decreased resolution did not prove to be a problem during practical work with the arthroscope, however. As **Fig. 16a–c** illustrates, the image quality is fine for evaluating the intra-articular structures and using instruments through the integrated working channel.

Irrigating the joint at a pressure of 1000 mm H₂O with an infusion system was sufficient to maintain a clear image throughout the procedure.



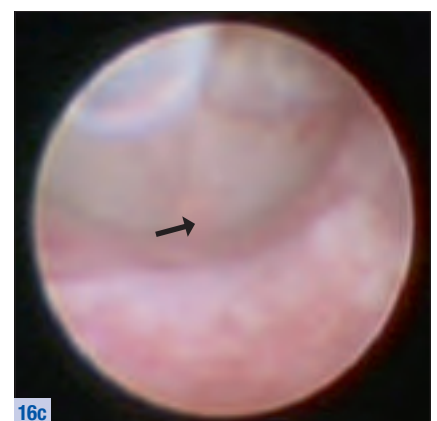
16a

View of a human right TMJ using the arthroscope with integrated working channel. The image shows the posterosuperior junction of the retrodiscal tissue with the synovial membrane.



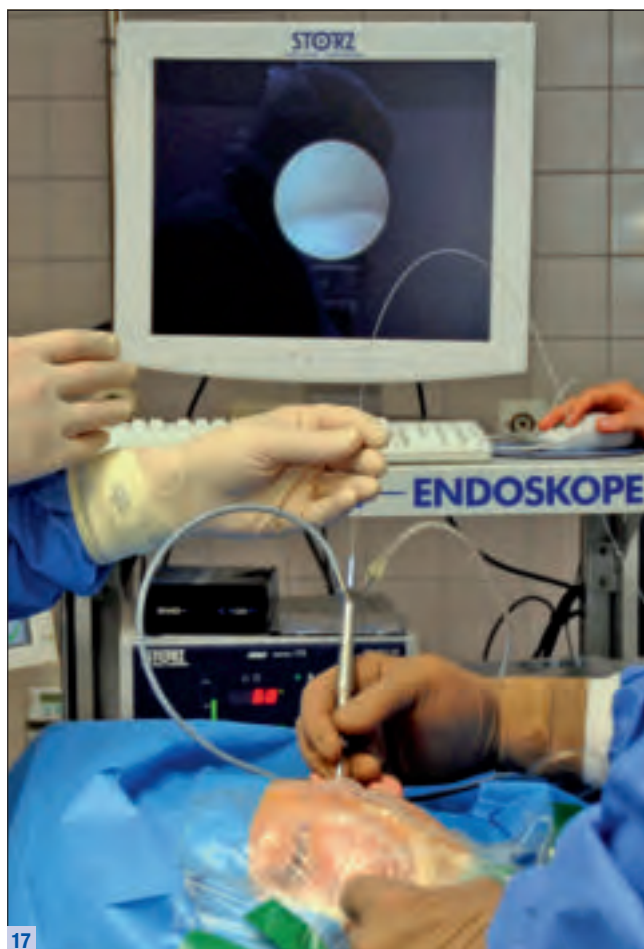
16b

Water-jet applicator aimed at the retrodiscal tissue of the TMJ.



16c

Nd:YAG laser fiber with pilot beam (**arrow**) aimed at the junction of the first and second thirds of the retrodiscal tissue.



17 Handling of the TMJ arthroscope with integrated working channel (model 11578 A, KARL STORZ GmbH & Co. KG, Tuttlingen, Germany). Here the Hydro-Jet applicator is being advanced into the joint. The TMJ disc and articular tubercle are visible on the monitor. The static image displayed on the video monitor (taken during TMJ arthroscopy in a human patient) shows the articular disc positioned directly beneath the left articular tubercle.

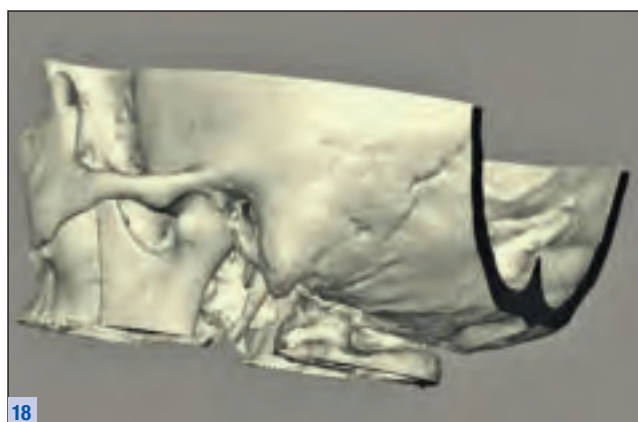
The handling of the arthroscope was excellent. Because the use of a laser fiber or water-jet scalpel no longer requires a second portal for the working channel and does not require triangulation, the procedure time was shortened by more than 50%. An arthroscope with an integrated working channel significantly reduces the technical difficulty of TMJ arthroscopy (**Fig. 17**).

The new configuration of the endoscope and its increased length allow it to be fitted with a navigation antenna (BrainLAB). Digital tomographic volume data sets, for example, can be used to navigate through the joint, providing even better guidance of arthroscope insertion and positioning within the joint space (**Fig. 18**) and adding new research capabilities for the further advancement of arthroscopy.

Because arthroscopic procedures no longer require a second portal for the working channel in cases where the working instrument can fit through the 1.1-mm integrated working channel, it is reasonable to assume that TMJ arthroscopy can be performed even less invasively with less pain and trauma to the joint.

After the TMJ arthroscope with integrated working channel had been tested in animal studies, we began using it in patients in September of 2009.

Consistent with our experimental findings, we confirmed that TMJ arthroscopy could be performed in patients much more easily with the new instrument. This results in a much shorter learning curve for maxillofacial surgeons who are new to the procedure.



18 Three-dimensional CT image displays the close anatomic relationship among the TMJ, the external auditory canal, and the middle and inner ear. This underscores the potential value of navigation-assisted TMJ arthroscopy in preventing complications.

The TMJ arthroscope with integrated working channel offers advanced technical possibilities for arthroscopic surgery. For example, it is conceivable that two of these endoscopes could be introduced into the joint space to facilitate arthroscopic suturing techniques. Moreover, the integrated working channel provides enhanced technical

capabilities that could be useful for other applications in oromaxillofacial surgery, facial plastic surgery, and otorhinolaryngology such as paranasal sinus endoscopy. The inherently larger endoscope diameter also helps to simplify design and manufacturing.

7.0 Concluding Remarks

Practice operations in the animal model have yielded the important discovery that beginners in particular must exercise a great deal of patience when locating and placing the arthroscope sheath (triangulation technique) in order to achieve the goal of the arthroscopic procedure. The new TMJ arthroscope, with its integrated working channel, can alleviate this problem by limiting the need for triangulation to procedures that require instrument diameters larger than 1.1 mm and specialized techniques. A second important insight is the need to stay in contact with the bone of the glenoid fossa when introducing the arthroscope into the upper joint space. We have found that when this rule is ignored, the arthroscopy invariably fails. This can lead to disc perforations and retrodiscal injuries that are extremely difficult to repair. When work in patients is deferred until the operator has gained adequate experience with TMJ arthroscopy in the animal model, the complication rate is correspondingly low.

Since neither cadaver training nor visiting physician programs can provide adequate experience, we supplement arthroscopic training in the porcine TMJ

with the study of human TMJ specimens in order to close this gap both for clinicians in training and for clinical researchers.

This course of training may then be followed by a visiting physician program and independent clinical work. We recommend that visiting physicians do their rotation individually with personal supervision rather than in groups. When arthroscopic shortening of the retrodiscal tissue with a water-jet scalpel (see Chapter 4.1) becomes an established technique, it will be possible to select patients for surgical treatment at a considerably earlier stage.

Another aspect is that the traditional policy of restraint based on concerns about the risks of open TMJ surgery need no longer prevail until the distress experienced by patients justifies the higher complication rate of open surgery.

In any case, a disorder of the masticatory muscles (myopathy) is always closely related to arthropathy and usually represents the primary and limiting disorder in the treatment of temporomandibular joint dysfunction.

8.0 Recommended Reading

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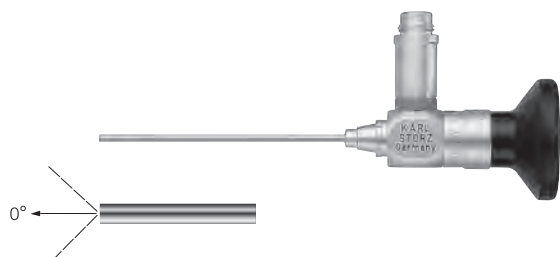
Instruments and Units for the Arthroscopy of the Temporomandibular Joint

Basic Set for Arthroscopy of the Temporomandibular Joint, consisting of:

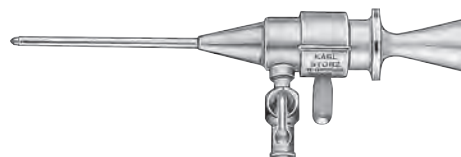
58705 AA	HOPKINS® Straight Forward Telescope 0° , diameter 1.9 mm, length 6.5 cm, autoclavable , fiber optic light transmission incorporated, color code: green
58706 AN	High Flow Arthroscope Sheath , diameter 2.5 mm, working length 4 cm, for use with HOPKINS® Telescope 0°, 58705 AA, color code: green
58705 BA	HOPKINS® Forward-Oblique Telescope 30° , diameter 1.9 mm, length 6.5 cm, autoclavable , fiber optic light transmission incorporated, color code: red
58706 BN	High Flow Arthroscope Sheath , diameter 2.5 mm, working length 4 cm, for use with HOPKINS® Telescope 30°, 58705 BA, color code: red
58706 BS	Obturator , sharp, for use with Arthroscope Sheaths 58706 AN/BN
58706 BT	Obturator , blunt, for use with Arthroscope Sheaths 58706 AN/BN
58717 X	Trocar , diameter 1.8 mm, length 4 cm, for use with 58717 XB/XS
58717 XS	Obturator , sharp, for use with Trocar 58717 X
58717 XB	Obturator , blunt, for use with Trocar 58717 X
58717 PZ	Biopsy Forceps , single-action jaws, diameter 1.3 mm, length 6 cm
58702 EO	Scissors , upbiting, diameter 2 mm, working length 10 cm
58702 EK	Scissors , downbiting, diameter 2 mm, working length 10 cm
58702 DH	Forceps , through-cutting, diameter 2 mm, working length 10 cm
58702 U	Grasping Forceps , diameter 2 mm, working length 10 cm
58702 M	Knife , bayonet-shaped, diameter 1.5 mm, working length 7.5 cm
58702 N	Sickle Knife , diameter 1.5 mm, working length 7.5 cm
58702 S	Palpation Hook , graduated, diameter 1.5 mm, length of hook 1 mm, working length 7.5 cm
58702 W	Changing Rod , for sheaths and trocars, length 15 cm
58702 X	Trocar , diameter 2.5 mm, length 3.5 cm, for use with instruments 58702 M/N/S
58702 XS	Obturator , sharp, for use with Trocar 58702 X
58702 XT	Obturator , blunt, for use with Trocar 58702 X

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

Basic Set for Arthroscopy of the Temporomandibular Joint



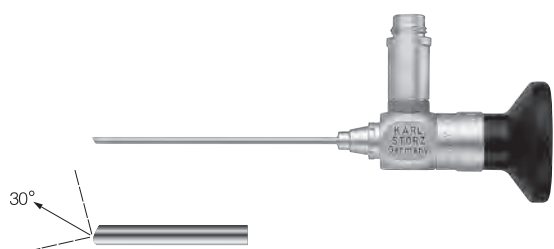
- 58705 AA **HOPKINS® Straight Forward Telescope 0°**, diameter 1.9 mm, length 6.5 cm, **autoclavable**, fiber optic light transmission incorporated, color code: green



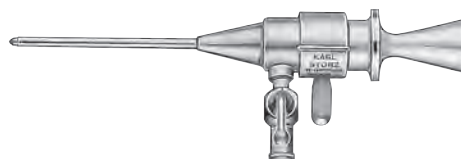
- 58706 AN **High Flow Arthroscope Sheath**, diameter 2.5 mm, working length 4 cm, for use with HOPKINS® Telescope 0°, 58705 AA, color code: green

- 58706 BS **Obturator**, sharp, for use with Arthroscope Sheaths 58706 AN/BN

- 58706 BT **Obturator**, blunt, for use with Arthroscope Sheaths 58706 AN/BN



- 58705 BA **HOPKINS® Forward-Oblique Telescope 30°**, diameter 1.9 mm, length 6.5 cm, **autoclavable**, fiber optic light transmission incorporated, color code: red



- 58706 BN **High Flow Arthroscope Sheath**, diameter 2.5 mm, working length 4 cm, for use with HOPKINS® Telescope 30°, 58705 BA, color code: red

- 58706 BS **Obturator**, sharp, for use with Arthroscope Sheaths 58706 AN/BN

- 58706 BT **Obturator**, blunt, for use with Arthroscope Sheaths 58706 AN/BN

Basic Set for Arthroscopy of the Temporomandibular Joint



58717 X **Trocar**, diameter 1.8 mm, length 4 cm,
for use with 58717 XB/XS

58717 XS **Obturator**, sharp,
for use with Trocar 58717 X

58717 XB **Obturator**, blunt,
for use with Trocar 58717 X



58702 X **Trocar**, diameter 2.5 mm, length 3.5 cm,
for use with instruments 58702 M/N/S

58702 XS **Obturator**, sharp,
for use with trocar 58702 X

58702 XT **Obturator**, blunt,
for use with trocar 58702 X

Basic Set for Arthroscopy of the Temporomandibular Joint



58717 PZ



58702 EO **Scissors**, upbiting, diameter 2 mm,
working length 10 cm



58702 EK **Scissors**, downbiting, diameter 2 mm,
working length 10 cm



58702 DH **Forceps**, through-cutting, diameter 2 mm,
working length 10 cm



58702 U **Grasping Forceps**, diameter 2 mm,
working length 10 cm



58717 PZ **Biopsy Forceps**, single-action jaws,
diameter 1.3 mm, length 6 cm



58702 N **Sickle Knife**, diameter 1.5 mm,
working length 7.5 cm



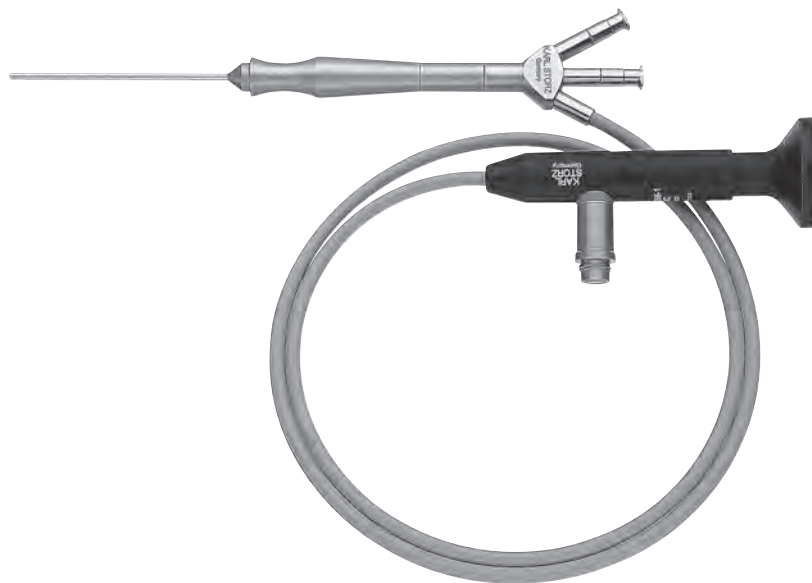
58702 M **Knife**, bayonet-shaped, diameter 1.5 mm,
working length 7.5 cm



58702 S **Palpation Hook**, graduated, diameter 1.5 mm,
length of hook 1 mm, working length 7.5 cm

58702 W **Changing Rod**, for sheaths and trocars,
length 15 cm

ALL-IN-ONE Temporomandibular Joint Arthroscope and Instruments



- 11578 A **Miniature Straight Forward Telescope 0°**, diameter 2.2 mm, working length 65 mm, **autoclavable**, working channel 1.4 mm, irrigation channel 0.25 mm, with remote eyepiece and fiber optic light transmission incorporated, for use with Trocar 11578 KA



- 11578 BS **Obturator**, sharp,
for use with Trocar 11578 KA
- 11578 BT **Same**, blunt



- 11578 KA **Trocar**, outer diameter 2.6 mm, working length 6.5 cm, graduated, for use with Telescope 11578 A and Obturators 11578 BS/BT

ALL-IN-ONE Temporomandibular Joint Arthroscope and Instruments

11578 PZ **Biopsy Forceps**, semirigid,
diameter 1.3 mm,
working length 20 cm,
for use with ALL-IN-ONE
TMJ Arthroscope 11578 A



11578 EO **Scissors**, semirigid,
diameter 1.3 mm,
working length 20 cm,
for use with ALL-IN-ONE
TMJ Arthroscope 11578 A



11578 S **Palpation Hook**, graduated,
working length 21 cm,
for use with ALL-IN-ONE
TMJ Arthroscope 11578 A



11580 B **Metal Tray**, for sterilization and storage of one Miniature Straight Forward Telescope 11575 A, 11581 A, 11582 A or 11583 A, 11578 A, perforated, lid with silicone bridges, with port for irrigation connector, external dimensions (w x d x h): 275 x 178 x 35 mm

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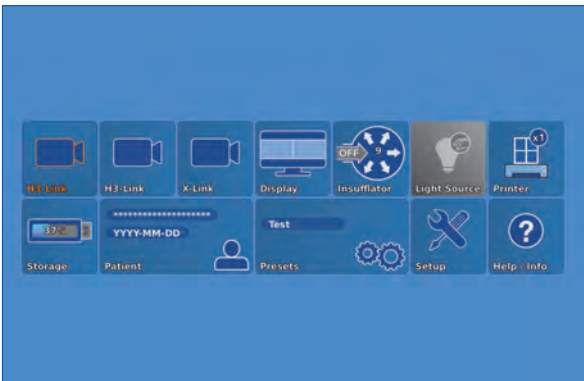
- Sustainable investment
- Compatible with all light sources



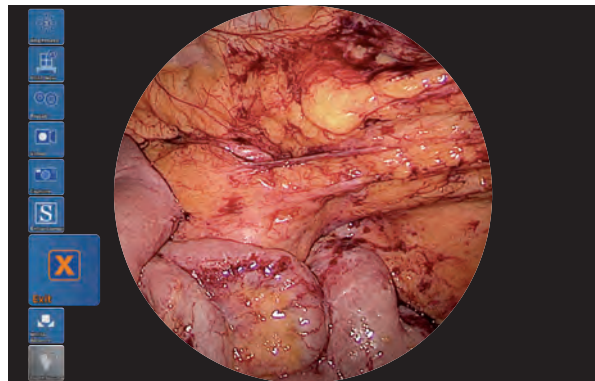
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- Dashboard: Complete overview with intuitive menu guidance
- Live menu: User-friendly and customizable
- Intelligent icons: Graphic representation changes when settings of connected devices or the entire system are adjusted

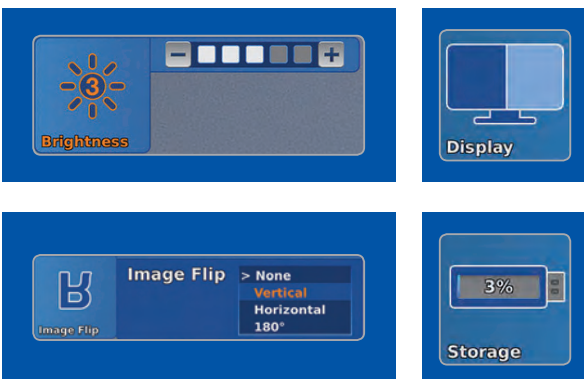
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- Side-by-side view: Parallel display of standard image and the Visualization mode
- Multiple source control: IMAGE1 S allows the simultaneous display, processing and documentation of image information from two connected image sources, e.g., for hybrid operations



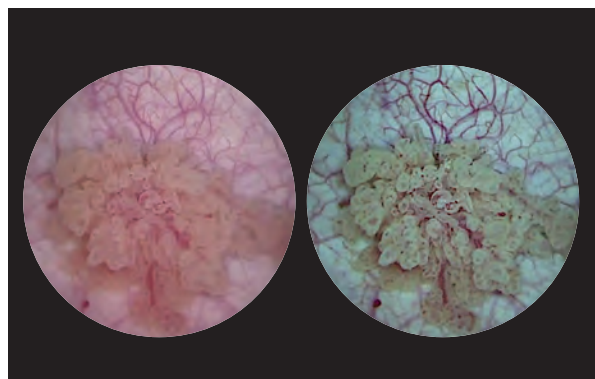
Dashboard



Live menu



Intelligent icons



Side-by-side view: Parallel display of standard image and Visualization mode

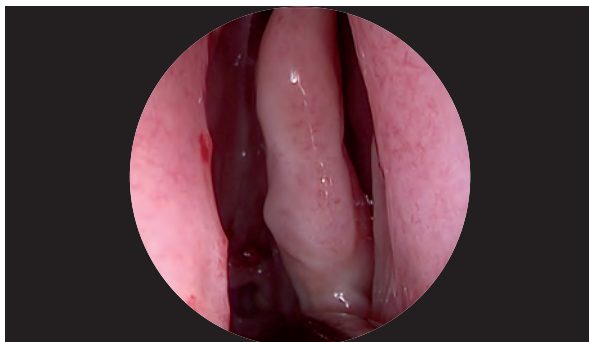
IMAGE1 S Camera System ^{NEW}



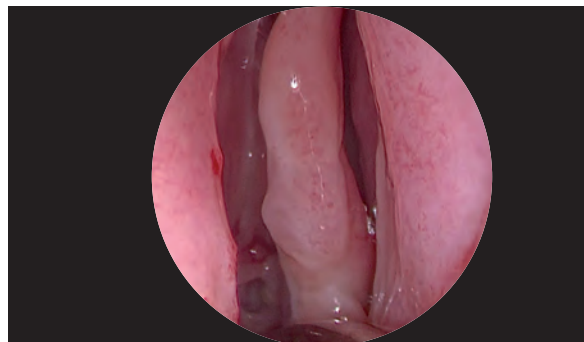
Brilliant Imaging

- 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



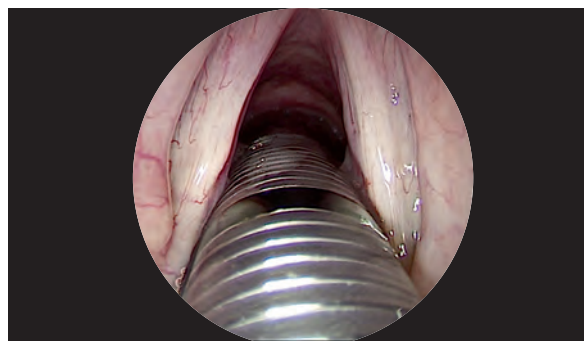
FULL HD image



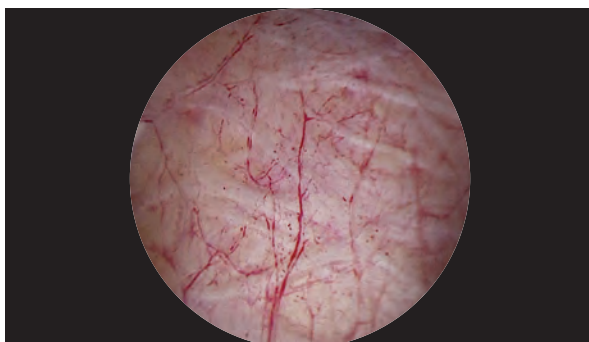
CLARA



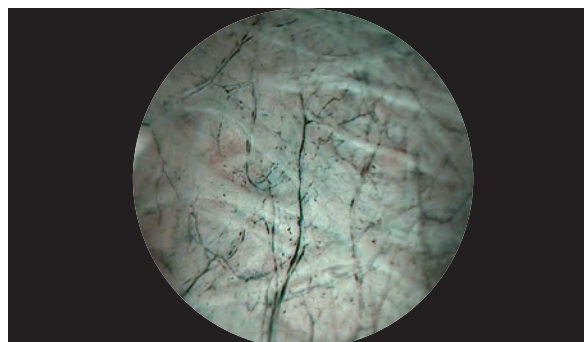
FULL HD image



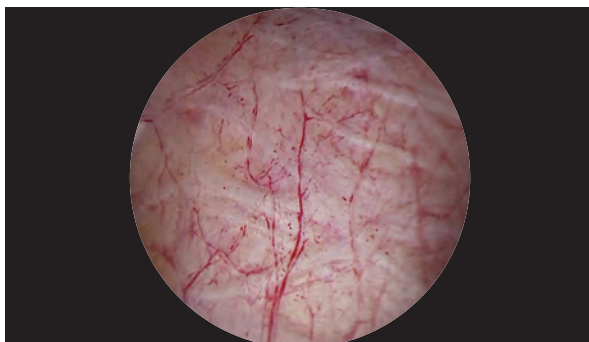
CHROMA



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 ^{NEW}

IMAGE1 S



TC 200EN

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

Specifications:

HD video outputs	- 2x DVI-D - 1x 3G-SDI
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 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:

Camera System	TC 300 (H3-Link)
Supported camera heads/video endoscopes	TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S) 22220055-3, 22220056-3, 22220053-3, 22220060-3, 22220061-3, 22220054-3, 22220085-3 (compatible without IMAGE1 S technologies CLARA, CHROMA, SPECTRA*)
LINK video outputs	1x
Power supply	100–120 VAC/200–240 VAC
Power frequency	50/60 Hz
Protection class	I, CF-Defib
Dimensions w x h x d	305 x 54 x 320 mm
Weight	1.86 kg

* SPECTRA A: Not for sale in the U.S.

** SPECTRA B: Not for sale in the U.S.

IMAGE1 S Camera Heads ^{NEW}

IMAGE1 S

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

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:

IMAGE1 FULL HD Camera Heads	IMAGE1 S H3-Z
Product no.	TH 100
Image sensor	3x 1/8" CCD chip
Dimensions w x h x d	39 x 49 x 114 mm
Weight	270 g
Optical interface	integrated Parfocal Zoom Lens, $f = 15-31$ mm (2x)
Min. sensitivity	F 1.4/1.17 Lux
Grip mechanism	standard eyepiece adaptor
Cable	non-detachable
Cable length	300 cm



TH 104

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:

IMAGE1 FULL HD Camera Heads	IMAGE1 S H3-ZA
Product no.	TH 104
Image sensor	3x 1/8" CCD chip
Dimensions w x h x d	39 x 49 x 100 mm
Weight	299 g
Optical interface	integrated Parfocal Zoom Lens, $f = 15-31$ mm (2x)
Min. sensitivity	F 1.4/1.17 Lux
Grip mechanism	standard eyepiece adaptor
Cable	non-detachable
Cable length	300 cm

Monitors



9619 NB

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

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	19"	26"
Wall-mounted with VESA 100 adaption	9619 NB	9826 NB
Inputs:		
DVI-D	●	●
Fibre Optic	-	-
3G-SDI	-	●
RGBS (VGA)	●	●
S-Video	●	●
Composite/FBAS	●	●
Outputs:		
DVI-D	●	●
S-Video	●	-
Composite/FBAS	●	●
RGBS (VGA)	●	-
3G-SDI	-	●
Signal Format Display:		
4:3	●	●
5:4	●	●
16:9	●	●
Picture-in-Picture	●	●
PAL/NTSC compatible	●	●

Optional accessories:

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

Specifications:

KARL STORZ HD and FULL HD Monitors	19"	26"
Desktop with pedestal	optional	optional
Product no.	9619 NB	9826 NB
Brightness	200 cd/m ² (typ)	500 cd/m ² (typ)
Max. viewing angle	178° vertical	178° vertical
Pixel distance	0.29 mm	0.3 mm
Reaction time	5 ms	8 ms
Contrast ratio	700:1	1400:1
Mount	100 mm VESA	100 mm VESA
Weight	7.6 kg	7.7 kg
Rated power	28 W	72 W
Operating conditions	0–40°C	5–35°C
Storage	-20–60°C	-20–60°C
Rel. humidity	max. 85%	max. 85%
Dimensions w x h x d	469.5 x 416 x 75.5 mm	643 x 396 x 87 mm
Power supply	100–240 VAC	100–240 VAC
Certified to	EN 60601-1, protection class IPX0	EN 60601-1, UL 60601-1, MDD93/42/EEC, protection class IPX2

Data Management and Documentation

KARL STORZ AIDA® – Exceptional documentation



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

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

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



WD 200-XX* **AIDA Documentation System**,
for recording still images and videos,
dual channel up to FULL HD, 2D/3D,
power supply 100-240 VAC, 50/60 Hz

including:

USB Silicone Keyboard, with touchpad

ACC Connecting Cable

DVI Connecting Cable, length 200 cm

HDMI-DVI Cable, length 200 cm

Mains Cord, length 300 cm



WD 250-XX* **AIDA Documentation System**,
for recording still images and videos,
dual channel up to FULL HD, 2D/3D,
including SMARTSCREEN® (touch screen),
power supply 100-240 VAC, 50/60 Hz

including:

USB Silicone Keyboard, with touchpad

ACC Connecting Cable

DVI Connecting Cable, length 200 cm

HDMI-DVI Cable, length 200 cm

Mains Cord, length 300 cm

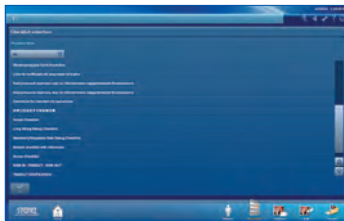
*XX Please indicate the relevant country code
(DE, EN, ES, FR, IT, PT, RU) when placing your order.

Workflow-oriented use



Patient

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



Checklist

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



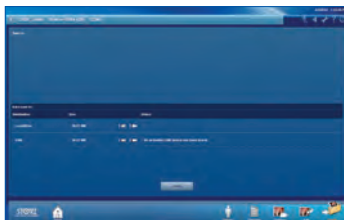
Record

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



Edit

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



Complete

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



Reference

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

Accessories for Video Documentation



- 495 NL **Fiber Optic Light Cable**,
with straight connector, diameter 3.5 mm,
length 180 cm
- 495 NA **Same**, length 230 cm

Cold Light Fountain XENON 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

Cold Light Fountain XENON NOVA® 300



- 20134001 **Cold Light Fountain XENON NOVA® 300**,
power supply:
100–125 VCA/220–240 VAC, 50/60 Hz
including:
Mains Cord
- 20133028 **XENON Spare Lamp**, only,
300 watt, 15 volt

Equipment Cart



UG 220

UG 220

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

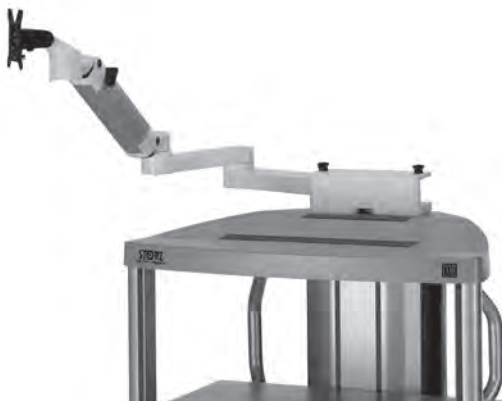
Beam package equipment, equipment cart high

3x **Shelf**, wide

Drawer unit with lock, wide

2x **Equipment rail**, long

Camera holder



UG 540

UG 540

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

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

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

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:

