



- Decompression
- Nucleotomy
- Foraminotomy
- Annuloplasty
- Chromography
- Fragmentectomy



# TESSYS<sup>®</sup>

## Transforaminal Endoscopic Surgical System

Transforaminal endoscopic access path  
for the treatment of herniated discs and stenosis

Endoscopic surgery has been a routine procedure in laparoscopy and arthroscopy since the 1980s. The neuro and cardiac surgery endoscopic minimally invasive techniques were first introduced in the 1990s.<sup>1</sup> The last decade has seen a significant evolution of the minimally invasive procedures for spinal surgery which lessen post-operative pain, damage fewer structures and involve the removal of less soft tissue. Faster recovery is then possible.<sup>2</sup> Ongoing technological advances have resulted in increasingly sophisticated surgical approaches for disease-

specific treatment and ultimately allowed endoscopic spinal surgery to become a reality.

*“Endoscopic techniques may speed recovery, minimize post-operative pain, and improve the final outcome. Healing processes which once took three to six months now require no more than three to six weeks!”*

The Cleveland Clinic Foundation

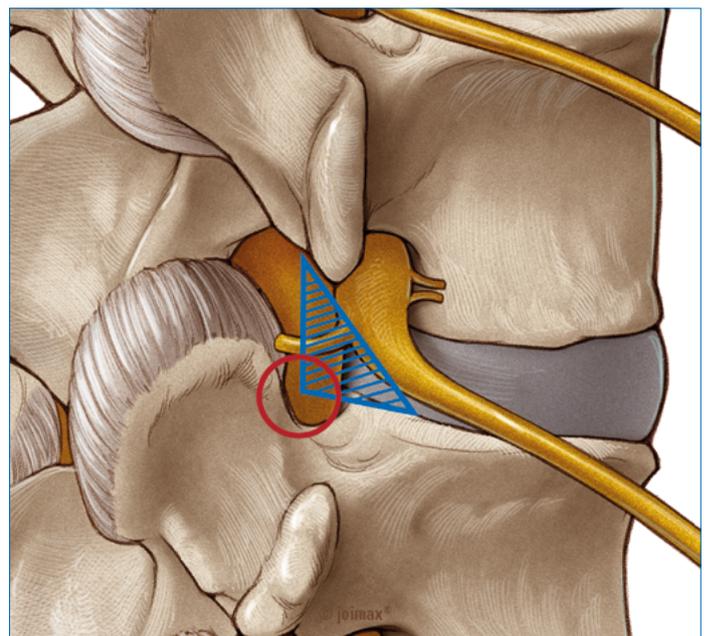
## Pioneers in Endoscopic Spine Surgery

Minimally invasive spinal surgery has developed into an alternative and safe procedure for a range of spinal column disorders. The surgical technique is particularly suitable for discectomy, the treatment of herniated discs or to stabilize unstable spinal column segments. Mixer, Barr<sup>3</sup>, and Dandy<sup>4</sup> are known for their work on the diagnosis and treatment of herniated discs and for using laminectomy to expose the lumbar spinal canal. Surgeons have been looking for alternative techniques to laminectomy and discectomy for more than 50 years, techniques such as removal of the nucleus by means of anterior retroperitoneal access<sup>5</sup>, automated percutaneous nucleotomy<sup>6</sup>, applying suction excision for lumbar herniated discs<sup>7</sup>, chemonucleolysis or laser ablation<sup>8, 9, 10, 11, 12</sup>.

In the 1970s, Parviz Kambin<sup>13, 14</sup> and Sadahisa Hijikata<sup>15</sup> began performing surgery using cannulas specially designed for percutaneous dorsolateral nucleotomy and achieved a documented success rate of 75 % for their technique. In the 1980s, the principle of mechanical nucleotomy was further advanced by other physicians.<sup>6, 16</sup>

Today's advanced endoscopic understanding of the anatomy of the intra and extraforaminal zones<sup>17</sup> and Kambin's<sup>18, 19, 20</sup> radiological determination of orientation points for the working zone around the dorsolateral area of the annulus, combined with the ready availability of smaller endoscopes, have made lateral access possible.

A number of lateral access techniques have been described by Anthony Yeung<sup>21</sup>, Thomas Hoogland<sup>22</sup>, and Sang Ho Lee et al.<sup>23</sup>. The TESSYS® method using joimax® technology is a combination of the access methods and techniques and used by many surgeons. It has been the subject of numerous published articles and applied successfully in thousands of procedures.



Parviz Kambin's triangle and the working zone for TESSYS® access (circle)

## TESSYS® – CONCEPT

The TESSYS® method uses a lateral transforaminal endoscopic access path to remove disc herniation. It is known to be a particularly gentle method for patients. Disc herniation or sequestered disc material is removed via direct access through the foramen, which is gradually dilated with special reamers and instruments. The patient is in a stable lateral or prone position during the procedure and responsive throughout surgery under analgesic sedation. The TESSYS® surgical procedure is performed in hospitals and outpatient centers, and reimbursed in Germany.<sup>24, 25, 26, 27</sup>

### Benefits for patients:

- Minimal destabilization
- Minimal traumatization
- Hardly any scar tissue
- Very rapid recovery



X-ray image: lateral

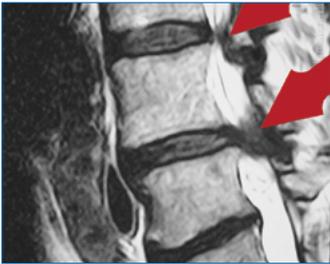


X-ray image: AP

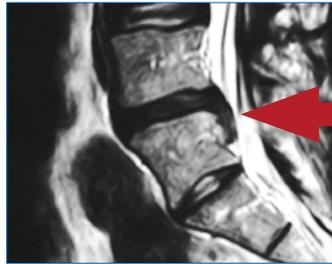
Almost all herniated discs and free sequesters can be treated with the combination of the TESSYS® method with TESSYS® technology, regardless of their position, including L5-S1. The surgical procedure uses the lateral transforaminal access and can be performed under analgesic sedation.

All radicular symptoms caused by herniated discs that have not improved with conservative management are indications for surgery with the TESSYS® surgical procedure. An indication of cauda equina syndrome requires immediate surgical intervention. Every surgical procedure on a spinal disc, including TESSYS® surgery, has to be planned carefully using Magnetic Resonance Imaging (MRI) and/or Computed Tomography (CT), and multiple conventional X-ray images.

For some patients, the exact position of the herniated disc can be identified intraoperatively with chromography and displayed as colored disc tissue.



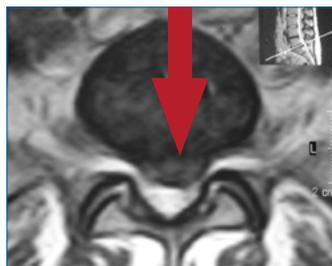
MRI: L3-L4 and L4-L5 lateral



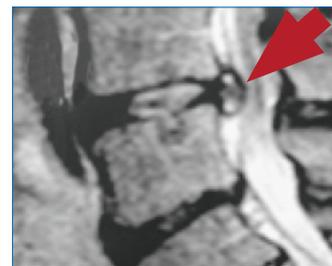
MRI: L4-L5 lateral caudal



MRI: L5-S1 lateral



MRI: L5-S1 axial



MRI: L3-L4 lateral before TESSYS® intervention

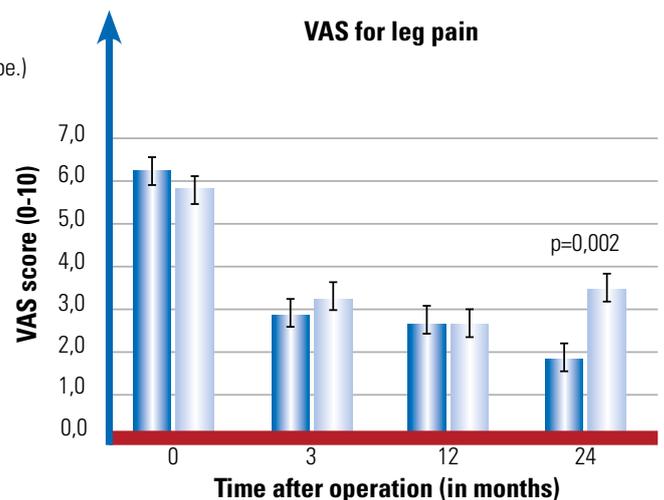
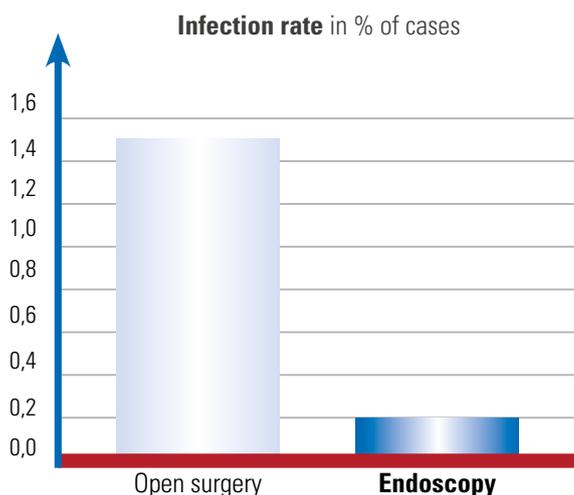


MRI: L3-L4 lateral after TESSYS® intervention

TESSYS® – STATISTICS

Publications and studies on endoscopic spinal surgery are increasingly featured in international medical literature. There are many obvious advantages of endoscopic surgery, McAfee et al., for instance, showed that there is a considerably lower risk of infection in comparison to open surgery (Fig. bottom left).<sup>28</sup> In a randomized study, Gibson et al. compared the transforaminal endoscopic disc

operation to the micro-surgical operating procedure. Both patient groups benefited from the operation, although after two years, pain in the more strongly affected leg was significantly lower in the group of patients who had been treated endoscopically (Fig. bottom right).<sup>29</sup>



Correct positioning of the patient and careful planning of the main point of access to the herniated disc are crucial for good surgical results.

Direct access to the herniated disc is gained through the intervertebral foramen from which nerve root exit. The intervertebral

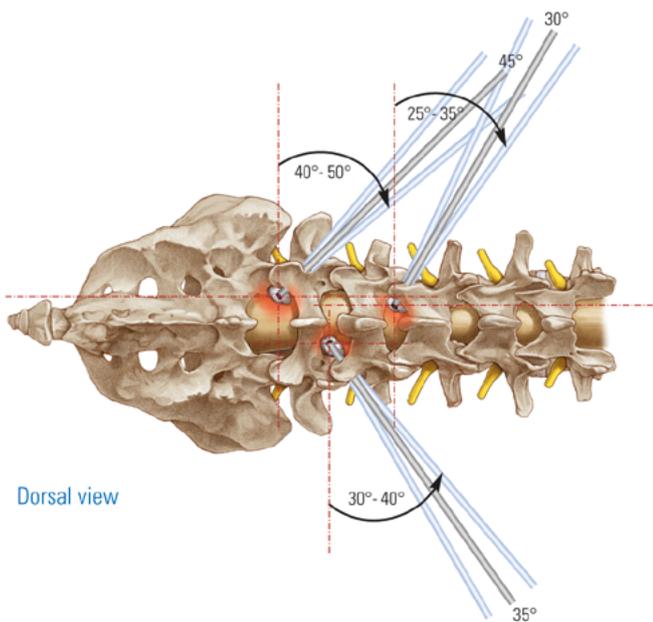
foramen can be anatomically narrow depending on its position (L1-L5) and age of the patient. To ensure safe access to the spinal canal and avoid irritation of the nerves in the foramen, entry is made through the caudal part of the foramen, which is widened millimeter by millimeter using special reamers (see also Product Usage Guide).



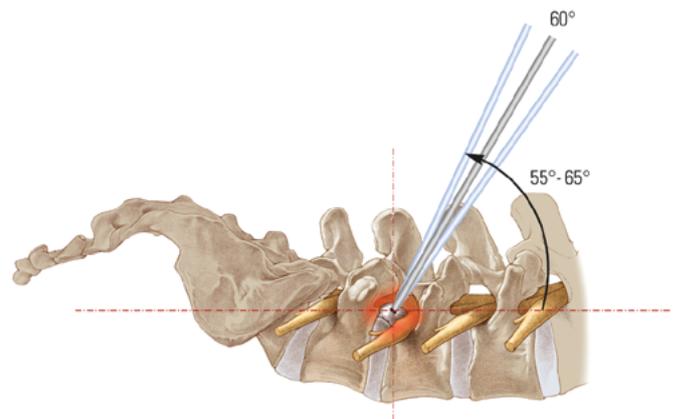
Stable lateral position



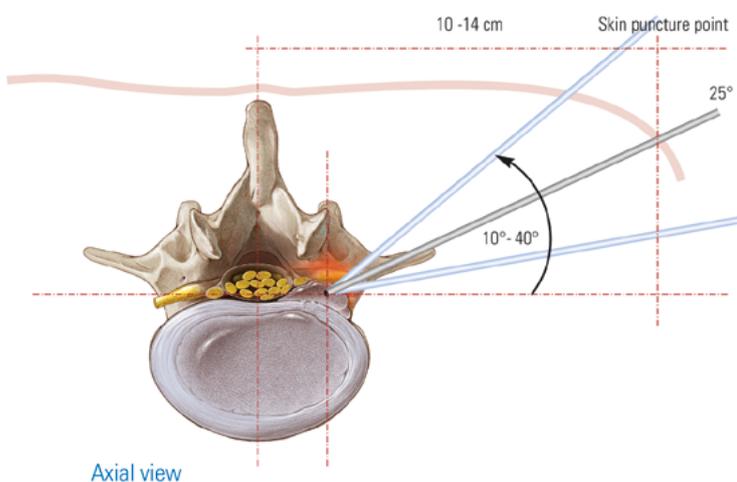
Prone position



Dorsal view



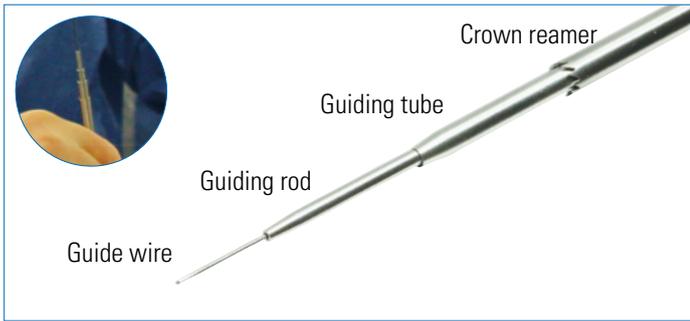
Lateral view



Axial view

The access points are assessed laterally. The entry point for L3-L4 is approx. 8 - 10 cm (3.15 - 3.93 inches), for L4-L5 approx. 10 - 12 cm (3.93 - 4.72 inches), and L5-S1 it is approx. 12 - 14 cm (4.72 - 5.51 inches) from the middle of the back.

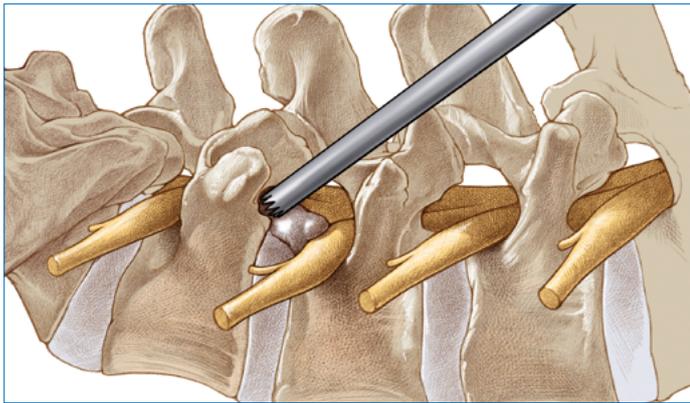
The figures illustrate the dorsal, lateral, and axial views of the entry angle.



Three-step guide wire concept

A 3-step guide wire concept (see Fig. left) is used to access the prolapse. The (soft) tissue path is gradually dilated under real time X-ray control, and the foramen is gradually stretched using the reamers described. This provides a safe, tissue-conserving access corridor to the spinal canal and the prolapse.

All TESSYS® instruments (guiding rods, guiding tubes, disposable reamers, and reamer ejectors) are color-coded in the logical sequence of a traffic light: green-yellow-red. The green marked instruments have the smallest diameter and the red ones the largest.



Widening of the intervertebral foramen with a crown reamer

The crown reamer tothing is designed in such a way that soft tissue is not at risk when rotated in the counter-clockwise direction. As soon as the reamer meets bone, which is easily felt, clockwise rotation is applied to drill the bone.



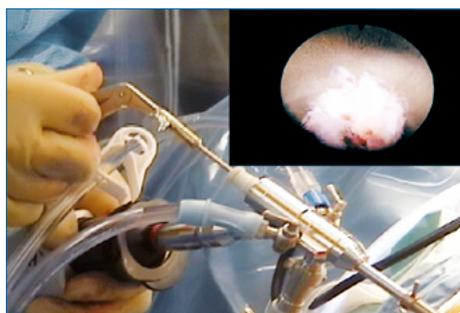
Removal of the spinal disc sequester under endoscopic view

Once the tissue and the foramen have been sufficiently stretched, loose tissue and prolapsed material can be removed with the help of specially designed gripping, cutting, and punching forceps, under full endoscopic view provided by Full HD endoscopes (foraminoscopes). Having evacuated all prolapsed fragments, an endoscopic check is performed to verify that the affected nerve root has been relieved of pressure and can move freely.

The TESSYS® surgical procedure can be learned in special training courses (see joimax® Education Program, page 10). For further information, please contact us directly, or contact your local joimax® representative.



Colored prolapse tissue (chromography)



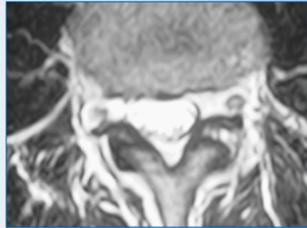
Deherniation using forceps



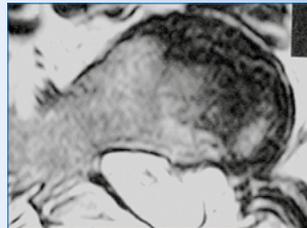
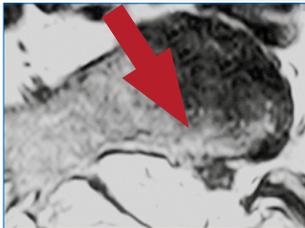
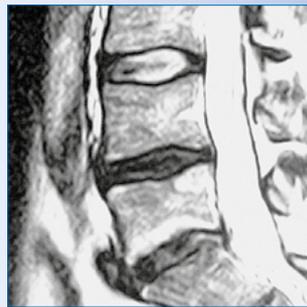
Spinal disc sequester: 4 cm (1.57 inches) dyed with indigo carmine

**Before surgery:**

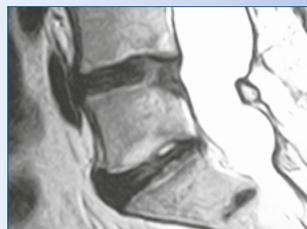
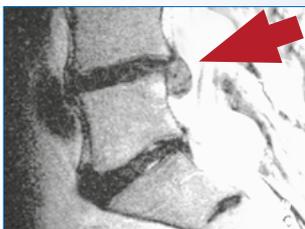
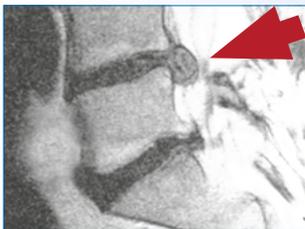
**After surgery:**



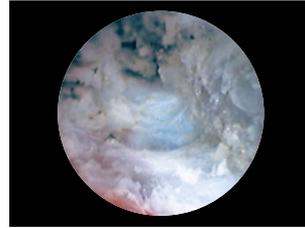
43-year-old man: L3-L4, lateral cranial (intraforaminal)



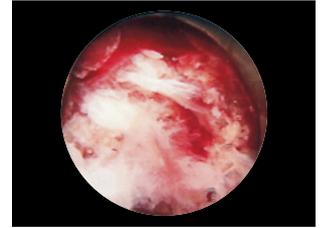
49-year-old man: L5-S1, left caudal



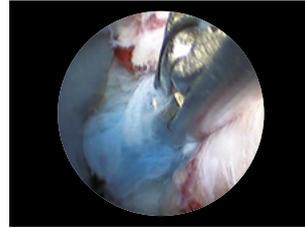
L4-L5, bilateral view



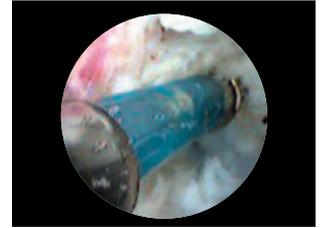
Herniated disc (colored)



Herniated disc



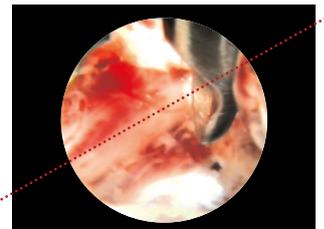
Removal of the prolapse using endoscopic forceps



Radio frequency probe Vaporflex®

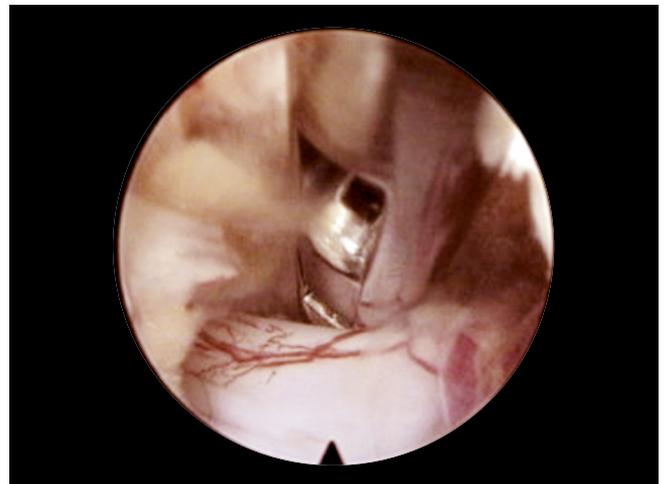


Exposed nerve root



Exposed nerve root from 8 am to 2 pm

**Tissue in the immediate vicinity of the nerves can be removed by working under direct endoscopic view.**



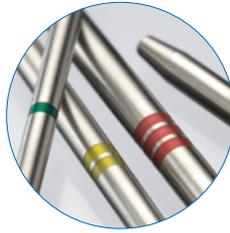
Exposed nerve root

**The TESSYS® System**

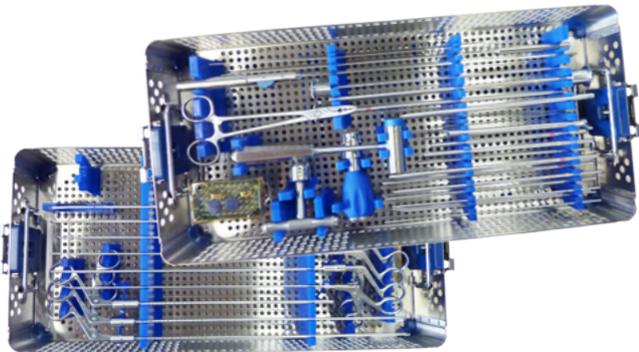


Disposable access kit with color-coded reamers in a range of sizes

Color-coded instruments



- **Red:** Caution, you are working very close to the nerve!
- **Yellow:** Caution, you are close to the nerve!
- **Green:** You are working at a safe distance from the nerve!



TESSYS® Instrument set

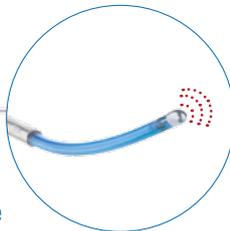
Patented LOPS forceps system



TESSYS® Foraminoscope



Vaporflex® RF Probe



**Endovapor® 2**  
Multi Radio Frequency System

- Specially integrated programs for spinal surgery, bipolar and monopolar
- All-in-one generator with interdisciplinary application
- Arc control for safe application
- Easy, intuitive touchpad operation
- Easy neutral electrode monitoring



**Practical and consistent: the disposable access kits**

Disposable products are required in all surgeries. Aiming to make your work easier, joimax® has developed a special disposable sterile access kit. So, the instruments you need are guaranteed to be to hand while simultaneously saving you time and simplifying the process of endoscopic surgery. The set contains all the disposable products you need during surgery: puncture needles, needles, reamers, syringes, dishes, marker pen, scalpel, guide wire and an endoscope sealing cap.

We provide a range of access kits with various types of reamers to suit your requirements. We differentiate between fine and coarse crown reamers, which, like the guiding rods and tubes are also color-coded for easier handling (green = 5 mm/0.2 inches, yellow = 6.5 mm/0.26 inches and red = 7.5 mm/0.3 inches). Additional disposable reamers are available individually sterile packed in undersize 4 mm/0.16 inches (blue) and oversize 8.5 mm/0.33 inches (purple).

**Instrument set – high precision, high durability**

The TESSYS® instrument set contains all the instruments required for safe, minimally invasive access to the spinal canal and the removal of disc tissue, bone spurs, or scar tissue (gripping, cutting, and punching forceps).

**joimax® Foraminoscope – a perfect view up to 4K UHD**

All foraminoscopes are available in the version C = single-cable technology (combo) or D version = ocular cone technology (ocular).

The following variants are available:

- Working length 171 mm/6.73 inches, working channel inner diameter 3.7 mm/0.15 inches or 4.7 mm/0.19 inches outer diameter 6.3 mm/0.25 inches or 7.3 mm/0.29 inches
- XT working length 208 mm/8.19 inches, working channel inner diameter 3.7 mm/0.15 inches outer diameter of 6.3 mm/0.25 inches

All foraminoscopes have an irrigation and suction channel with an inner diameter of 1.5 mm/0.06 inches and an optical angle of 30°.

**Vaporflex® RF probe**

The radio frequency probe Vaporflex® is used to stop bleeding and remove scar tissue. Annular ruptures up to 3 mm/ 0.12 inches long are easy to seal with the tissue shrinking procedure.

We provide additional disposable materials such as the special foil for covering the patient, to contribute to good surgical outcomes. A separate tube set with Y connectors is available for the joimax® low-pressure Versicon® irrigation pump.

## Resection instruments for spinal stenosis

Spinal stenosis can be treated via transforaminal access under endoscopic control. The patented joimax® crown reamers and bone drills are perfect instruments for foramen and recess stenosis surgery. The Shrill® Shaver Blades and the endoscopic crown reamers (EndoReamer) were developed for endoscopic decompression surgery of the spinal canal.

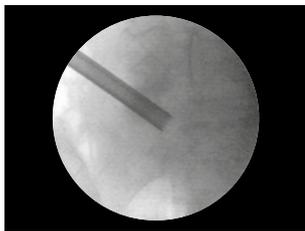
### Reamers or drills – X-ray control

The caudal foramen is extended with the crown reamers and bone drills under X-ray control to create space for the working tube. Bone can be removed from the superior articular process, the pedicle, and dorsal edge of the vertebral body (Kambin's triangle). Different sizes of crown reamers (4 - 8.5 mm/ 0.16 - 0.33 inches) and drills (4 - 9.5 mm/0.16 - 0.37 inches) are available for the minimally invasive, gradual expansion of the

#### Reamers

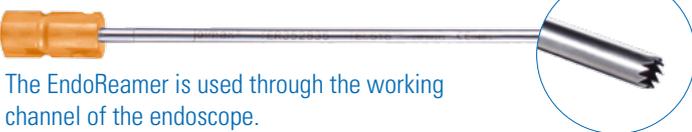


Color-coded reamers, available in five sizes, are inserted using the guiding tube.



Reamer in an X-ray image

#### EndoReamer



The EndoReamer is used through the working channel of the endoscope.



EndoReamer in the spinal canal

#### Bone drill



The bone drills are available in a variety of sizes, the size is indicated by stripes. They are inserted using the guide wire.



Bone drill in an X-ray image

foramen. The size of the instrument is indicated by a color-code for the reamers or bar-code for the drills.

### Shrill® Shaver Blades or EndoReamer – endoscopic monitoring

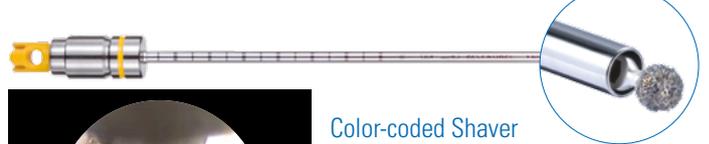
The joimax® Shrill® system was designed for resectioning soft and bony tissue during endoscopic spinal surgery. Even tissue very close to the nerve can be removed when working under direct endoscopic view. The blade most suitable for the surgery is selected according to the pathology and tissue – bone, joint capsule and ligament.

#### Color coding of attachments for easy identification:

**Yellow:** for safe bone resection near nerves, e.g. the diamond abrasor

**Red/Purple/Blue:** for resection of bone, e.g. the acorn trimmer

**Green:** for ablation of soft tissue, e.g. the tissue resector



Color-coded Shaver Blades are available with different tips, such as large diamond abrasor.

### Shrill® Deflector Shaver Blades

Controlled angulation for the ideal working position.

- Angle can be adjusted safely and conveniently using the lever on the shaft.
- Angle can be adjusted precisely to 12, 24 or 36°.
- Shaver Blades are securely fixed into place.



The Deflector Shafts are available in various lengths and are reusable. The Shaver Blades are available with different tips and are designed for single use.



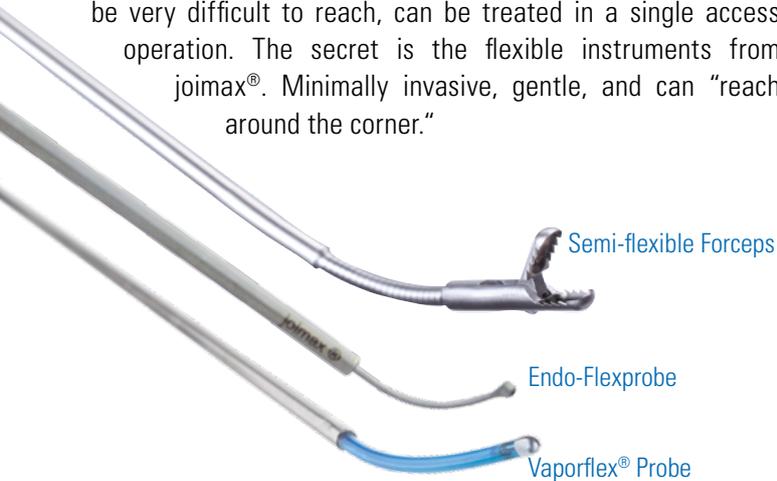
### Shrill® Shaver Drill System

- Handpieces and shaver blades specially developed for spine surgery
- Safe removal of soft tissue and bone in cases of stenosis
- Suction function ensures an unobstructed and clear view of the operating field
- Vacuum effect due to specially protected design

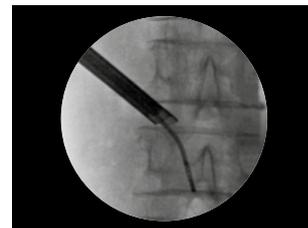


## Endoscopic decompression – with special instruments that “reach around the corner”

Herniated discs or spinal stenosis, which would otherwise be very difficult to reach, can be treated in a single access operation. The secret is the flexible instruments from joimax®. Minimally invasive, gentle, and can “reach around the corner.”



Treatment of a hypertrophic joint with the Deflector Shaver Blade



Semi-flexible Forceps

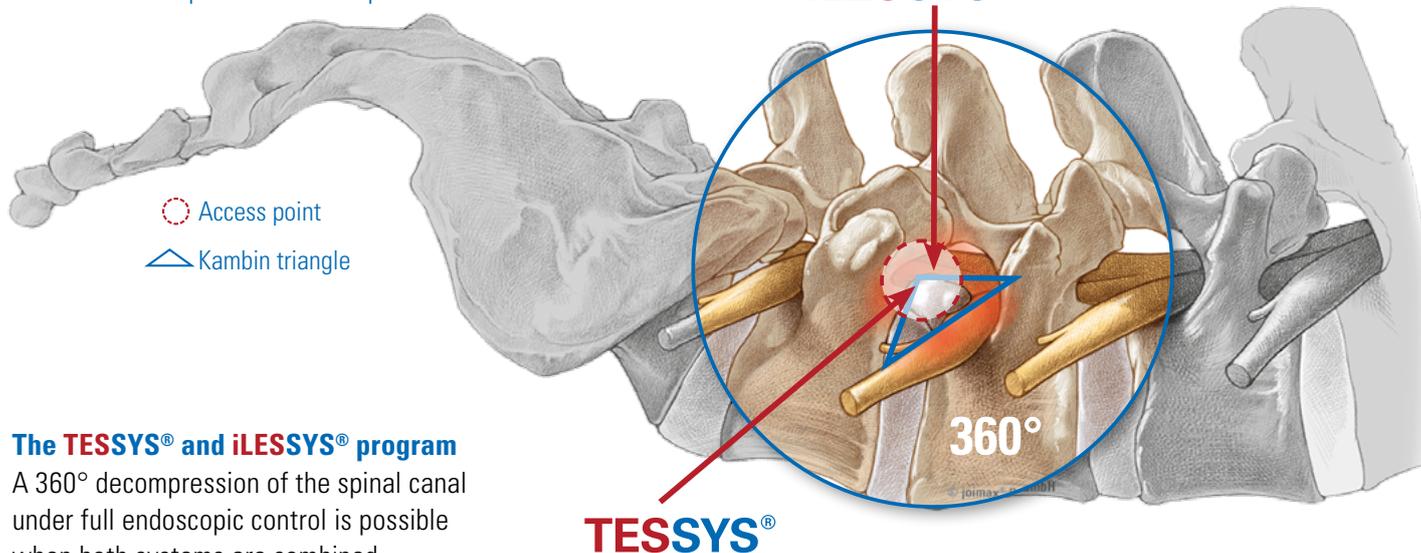
Biopsy forceps, controllable 35°



## TESSYS® / iLESSYS® in combination – 360° treatment of the spinal canal

### 2 access points – 1 target

The 360° decompression of the spinal canal



### The TESSYS® and iLESSYS® program

A 360° decompression of the spinal canal under full endoscopic control is possible when both systems are combined.

### iLESSYS® and iLESSYS® Delta

The iLESSYS® instrument set consists of one access tray and one resection tray. They both hold special instruments for endoscopic access through the lamina (laminotomy) or the ligamentum flavum (flavectomy). The iLESSYS® set is designed for minimally invasive treatment of disc herniation, the iLESSYS®-Delta set is suitable for the treatment of central stenosis. The working length of the laminoscopes is 125 mm/4.92 inches. The Delta laminoscope has a working channel of 6 mm/0.24 inches and an outer diameter of 10 mm/0.39 inches. Thus, it is bigger than the iLESSYS® laminoscope (working channel 3.7 mm/0.15 inches, outer diameter 6.3 mm/0.25 inches).

### When to use TESSYS® and when iLESSYS® ?

Transforaminal access (TESSYS®) is the recommended access method to treat disc herniation, foramen stenosis, and stenosis of the ventral spinal canal. Interlaminary access is recommended for dorsal pathologies, e.g. central and recess stenosis and for dorsal disc herniation; the same applies when transforaminal access is not possible, e.g. for L5/S1 with a very high iliac crest line. Since the lamina windows are very large at L4/5 and L5/S1, few lamina structures need to be removed using iLESSYS®.

The TESSYS® surgical method permits the high-precision treatment of the spine with minimal injury to the surrounding tissue structures. This results in minor wound pain and very little scar tissue. In addition, the stability of the spine is unimpaired.

Since the technique utilizes analgesic sedation, it is suitable for all age groups and is an outpatient procedure, allowing patients to return more quickly to everyday life.

### Minimally invasive access – “gentle surgery”

- Tissue-conserving surgical access due to step-by-step tissue dilation using the Seldinger technique
- Visual endoscopic control during the operation
- Minimal destabilization and traumatization
- Small incision, only minor scarring
- Reduced risk of infection
- Short recovery time and rapid return to everyday life



The goal of the 3-step Continuing Medical Training Program is to provide the best possible learning process as well as outcome for both the surgeon and the entire surgical team.

Participants of the joimax® Training Program will become familiar with the surgical techniques while visiting reference centers in the first place. Theoretical and practical training of the endoscopic techniques in joimax® workshops will follow, and finally the newly acquired skills will be transferred and refined with our professional support during participant's own first endoscopic procedures.



### First Surgery

#### Operate on your own patients

- Safe and competent support by one of our reference doctors and/or a joimax® applications specialist
- Training for the entire surgical team

### Visitation

#### Experience live procedures

- Participation in surgical operations at our reference centers
- Share experiences with surgeons, anesthesiologists, the surgical staff and speak to patients

### Training on anatomical specimens

#### Train on surgical techniques – Step-by-Step

- Theory: Anatomy, indications/contraindications, case studies, anesthesiology, step-by-step surgical technique, instruments
- Hands-on training, tips and tricks

## joimax® Endoscopic Tower | Generation 4

The expert solution for spinal surgery and neurosurgery. All devices work in unison with one another and are specifically designed for the treatment of sensitive structures.

The image shows one of various mounting options.

### 1 Vitegra®

Visual Integration System

#### Fully integrated digital documentation system

- Wireless tablet to control the system from everywhere
- Video and snapshot function via camera head buttons
- Multiple video inputs for different signal sources like endoscopic camera, X-Ray, ultrasound, microscope, OR camera
- Voice control and voice-over video function
- Easy export of all patient data via Blu Ray, USB, LAN, DICOM



### 2 Camsource® LED

Camera & Light Source System

#### Brilliant images up to 4K

- Latest CMOS technology
- Full HD resolution via DVI, HD-SDI and 3G-SDI
- Integrated LED long-life light source, maintenance-free
- Combo and Ocular camera heads available

### 3 Intracs® em

Integrated Navigation Tracking & Control System

#### Simple and safe electromagnetic navigation

- Electromagnetic based tracking and guidance
- Instrument navigation directly at the tip
- Intuitive workflow and improved usability

### 4 Shrill®

Shaver Drill System

#### Multi-functional milling and resection system

- Handpieces and shaver blades specially developed for spine surgery
- Safe removal of soft tissue and bone in cases of stenosis
- Suction function ensures an unobstructed and clear view of the operating field
- Vacuum effect due to specially protected design

### 5 Endovapor® 2

Multi Radio Frequency System

#### Combines variety of different electro-surgical modes and effects

- Specially integrated programs for spinal cord surgery
- All-in-one RF generator with interdisciplinary application
- 4 sockets: 2 x monopolar, 2 x bipolar
- Easy, intuitive touchpad operation
- Arc control for safe application
- Easy neutral electrode monitoring

### 6 Versicon®

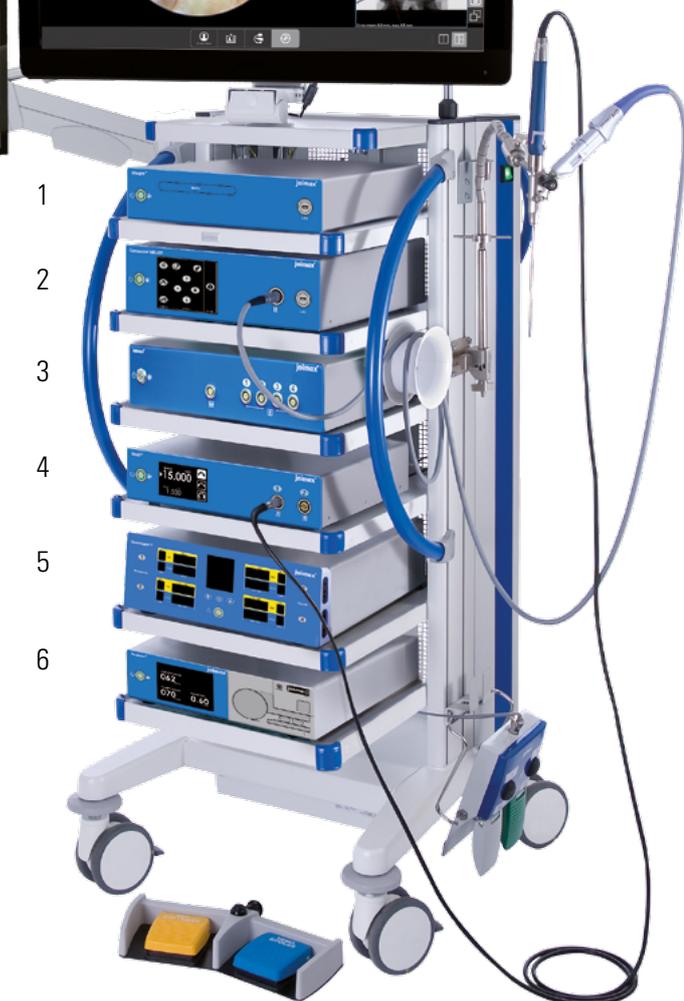
Versatile Irrigation Control

#### Multi-range irrigation pump

- Integrated spine mode for low flow and pressure
- Permanent control of flow and pressure
- Rapidly insertable, disposable tube set
- Replaceable patient line with check valve

### 7 JFMS 2620 | 3220 | 4K31

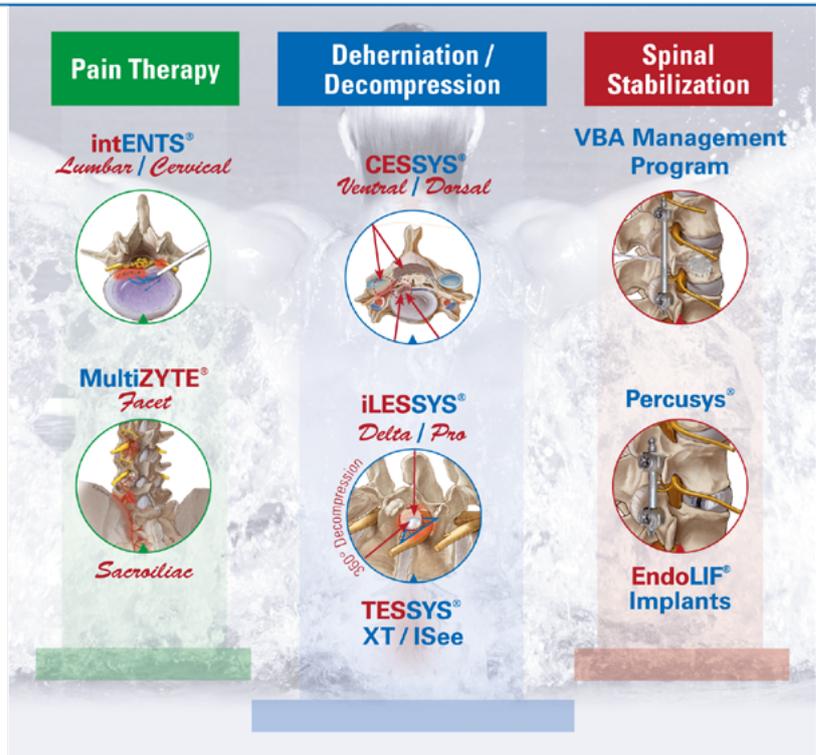
High Definition Medical Displays FHD and 4K UHD



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