ADONIS®

Transforaminal lumbar interbody fusion
The TLIF technique is based on creating unilateral access to the intervertebral disc space by entering via an intervertebral foramen. Thus the TLIF method allows a single posterior access enabling a “360°” fusion, which, amongst other benefits, offers the following advantages compared to the PLIF method:

- Unilateral facet resection
- Preservation of the lamina arch
- Preservation of the contralateral facet
- Minimal dural retraction
- Reduced risk of intradural scarring
- Revision strategy - only unilateral scarring

ADONIS®-TLIF is an intelligent and, by virtue of the associated set of instruments, highly rational interbody device system that is a widely recognised and accepted product line offering the following benefits:

**Anatomical**
- Geometry is identical to the patient’s own sectional and sagittal anatomy
- Generous contact surface - reduced risk of migration

**Stable**
- Antegrade toothing for stable anchorage
- Convex contact surfaces for secure and permanent high-precision seating
- Significantly increased extraction forces
- Extremely high friction coefficient

**Reliable**
- Large filling aperture for rapid fusion
- The conically shaped geometry of the cage which runs to the centre of the implant holds the filling material in the cage and increases the filling volume

**Modular**
Thanks to the choice of 3 materials:

- **Titanium**
The metal titanium has proven to be especially biocompatible and correspondingly easy to modify. It is proven that the various reactions of human cells are initiated by the surface oxides of the titanium materials, which are just a few nanometres thin.

- **PEEK**
The material exhibits a high level of biocompatibility and is characterised by a bone-like elasticity. A further advantage lies in the material’s abstract-free properties

- **PEEK titanium-coated**
The titanium coating which, due to the relation between pore depth, porosity and roughness, provides an optimum substrate, has proven to be ideal for the docking of bone cells to the implant. The osteoinductive properties of titanium enable bone to take root directly on the implant.
ADONIS®-TLIF
Interbody Device System

Product-specific advantages

- Modular
- Reliable
- Stable
- Anatomical
- Osseointegrative
ADONIS®-TLIF Classic

ADONIS® Classic is a solid titanium interbody device system and is a generally accepted product line for thoracolumbar indications. Coupled with a reliable and simple set of instruments, ADONIS® Classic is an ideal solution for thoracolumbar interbody fusions. The latest findings are used in the manufacturing of titanium implant materials with tailor-made surface properties. We exclusively use titanium Ti 6Al-4V ELI (as per DIN ISO 5832-3).

ADONIS®-TLIF Avantgarde

ADONIS® Avantgarde is an implant made from biocompatible PEEK-Optima® for the thoracolumbar interbody fusion used to treat degenerative disc diseases and instabilities. This X-ray transparent material enables rapid and straightforward assessment of the bone structure and the fusion process. X-ray markers serve to verify positioning. A mechanical stability of 3.6 GPa allows for optimal load transmission between the implant material and natural bone. This stimulates the bone healing processes. Our material, PEEK, has been tested in accordance with ISO 10993, has been classified in accordance with US P-VI, and the relevant FDA Device and Drug Master Files are available. Thanks to its material properties and its approval certificates, PEEK is predestined for use as an implant material.
ADONIS® Exclusive

ADONIS® Exclusive sets new benchmarks in the area of thoracolumbar interbody fusion. The titanium coatings of the new ADONIS® Exclusive cages combine the advantages of various materials in one implant. The basis of the implant is a solid Peek core. This core is coated with titanium to increase the surface area and thus also to maximise the contact zone between the implant and the vertebral body surface.

Properties of PEEK and R-PEEK-Ti-coated

- PEEK is transparent to X-rays and does not produce artefacts
- Position verification using X-ray markers
- Anatomical form and toothed or Ti-coated surface
- The semi-circular shape provides for a maximum contact area
- It can optionally be filled with bone or bone replacement material for improved bone grafting
- Firm connection to the application instrument

The titanium coating that, due to its balanced relationship between pore depth, porosity and roughness, affords an optimum substrate has proven to be ideal for docking bone cells in the implant. The osteoinductive properties of titanium enable bone to take root directly on the implant.

PEEK-OPTIMA® is a polyaromatic, semi-crystalline thermoplastic, which is based on the basic formula \((-\text{C}_6\text{H}_4-\text{O}-\text{C}_6\text{H}_4-\text{O} \text{C}_6\text{H}_4-\text{CO})_n\) and generally known as a polyether ether ketone.
Surgical Technique

Inserting the pedicle screws
Determine the approach positions of the pedicle screws. The optimum position is at the intersection of the transverse process and the pars interarticularis. The pedicle screws are implanted and their position verified by means of an X-ray image.

More information about the introduction of the pedicle screws is available in the respective operation manual for the dorsal system used.

Resection of the ligamentum flavum
In order to gain transforaminal access to the disc space, a unilateral facetectomy is performed. Frequently, the side chosen for the approach is determined by the location of the pathology or the presence of scar tissue.

Resect the ligamentum flavum from the anterior surface of the lamina with a curette.

Preparing the aperture for the transforaminal approach
The lower articular process is resected with a straight osteotome or a Kerrison punch. The capsular section of the ligamentum flavum is now revealed and can be detached. The upper articular process is now resected with a straight osteotome or a punch to expose the intervertebral foramen. The pedicle is exposed by removing the overhanging superior articular process with a punch to gain final access to the intervertebral disc.
Final approach to the intervertebral disc

The superior articular process is resected to expose the intervertebral foramen. Complete meticulous haemostasis must be ensured at the entry point of the disc space. Care should primarily be taken to observe the exiting nerve root and the lateral part of the dural sac. These structures can be protected in every stage of the operation with a dissector or nerve root retractor. Perform a box annulotomy to create a window to the disc space.

Initial distraction

An initial distraction of the intervertebral space is required to obtain access to the intervertebral disc for a radical discectomy. A distraction can be achieved by one of the following methods:
- Distraction via pedicle screws
- Distraction via the spinous process
- Distraction via retractors

The initial retractor is inserted horizontally with respect to the collapsed intervertebral disc space and then turned through 90 degrees to obtain a distraction. The distractors are available in both version, blunt and sharp.

Removal of the intervertebral disc

A radical discectomy is performed with a combination of curettes, chisels and Luer cannulas. It is important to ensure that the end plates are not damaged during this process. Curettes can be used for preparing the end plates. A straight or angled Luer or punch is then used to completely remove the loose disc material. If necessary, a straight osteotome can be used to resect the posterior lips of the upper and lower end plates to facilitate introduction of the cage. It is important during the preparation to create a straight, parallel surface for the introduction of the interbody implant.
Further distraction of the intervertebral disc space

Further distraction of the disc space prior to cage insertion can be achieved by utilising the range of distractors in the cleaned out and prepared disc space. The distractors are used sequentially until the appropriate annular tension has been achieved.

In order to maintain this distraction, the dorsal instruments are locked on the contralateral side.

Trial cage

A trial cage can be used prior to insertion of the implant to verify the cage placement and required implant height.

The trial implant must sit firmly when gently pressed in the intervertebral space and can be removed with the extractor handle.

Introduction of the cage

The implant is mounted on the insertion instrument. The insertion instrument may not be screwed too tightly to the cage. After the implant has been screwed on to the insertion instrument, the cage is filled with bone graft.
Correction and adjustment of the cage position

The inner part of the instrument can be removed after inserting the implant. It is important to ensure that the outer part remains in the cage. The outer part can now be swivelled medially, but still remains in the instrument holder of the cage. The cage can be rotated into its final position with X-ray monitoring by subsequently striking the outer part of the instrument. It is important for the TLIF cage to be positioned above the centre line of the spinal column. The final location of the cage is checked by an X-ray image.

Introducing the cage with the MTI

As an alternative to the standard individual instrument, the multi-axial individual instrument can also be used. For this, the implant is placed on the tip of the instrument, a certain amount of force being required when doing so. It must be noted that the internal functioning of the individual instrument is in the middle handle position during this time. The implant is then aligned in such way that comes to a stop at the instrument on the lateral edge of the instrument holder. In this position, the internal functioning of the insertion instrument is screwed into the front position. Now fill the cage with bone graft and insert. When doing so, it must be ensured that the implant’s internal functioning remains in its position so as to retain the alignment of the bone graft.

Positioning and releasing the cage

After the implant has been positioned in a straight alignment beyond the centre line of the vertebral body to the anterior, the internal functioning of the instrument is brought into the rear position. In this position, the implant is still firmly joined to the instrument, but is not aligned straight. Gently tapping the implant allows it to turn into its final position. As soon as the implant has reached its final position, the instrument is released from the cage. The internal functioning is brought back into the front position for this. The instrument jumps away from the implant and can be removed.
**Surgical Technique**

**Manipulation of the cage**

If it is necessary to remove the cage, the instrument can be put into the instrument holder of the implant. It must be noted that the internal functioning of the instrument is in the middle position. As soon as the instrument is in the holder, the internal functioning should be moved into the rear position in order to secure the connection between the instrument and implant. The implant can be removed. The knock-out hammer can also be pushed onto the end of the instrument as an aid. The implant can be removed by gentle taps to the rear.

**Caution:**
Revision of PEEK-Cages should be done carefully, as due to the material properties of PEEK, the retention force of the instrument in the implant is minimized.

**Introduction of the bone graft**

In order to achieve a solid interbody fusion, the disc space should be filled with as much bone graft material as possible.

**Final compression**

Final compression must be performed using the dorsal instruments.
Positioning of markers

To ensure the correct positioning of the cage, the cage must be screwed into the central position once it has been inserted into the intervertebral disc space. The five tantalum markers in the TLIF PEEK cage and the variant TLIF R-PEEK-Ti shown are used for a fluoroscopic view of the implant position and alignment. This makes it possible to assess the exact position of the cage by radiography. In the TLIF PEEK and TLIF R-PEEK-Ti, one marker is located medially at the anterior implant end and four markers are positioned in a rectangular arrangement at the posterior implant end. The four rectangular markers show the outer dimensions of the cage.

In the TLIF PEEK and TLIF R-PEEK-Ti implants, the four posterior markers and the anterior marker are visible on the X-ray for an implant positioned centrally within the disc space. In the sagittal view this resembles the five on a dice.
### Classic Titanium

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Osseointegration

The implant surface has major importance for anchoring the implant and for implant compatibility at the interface implant / adjacent tissue. The success and speed of osseointegration are significantly influenced by the surface of the implant.

Using an ideal implant surface, the biological responses between implant and bone can be optimised, and thus an earlier functional loading of implants can be achieved. The long-term success of an implant therapy concept is determined by multiple factors, but mainly by the bone density of the implant bed, the implant design and the implant surface. The composition, roughness and topography of the implant surface at the interface play an important role in primary stability and safe osseointegration. Rough implant surfaces will influence and stimulate the cellular activity of surrounding bony structures. Cell proliferation and cell differentiation, matrix synthesis and production of “tissue growth factors” are encouraged and lead to a dense bone-implant connection.

Specific surface roughness on the implant surface will encourage the regeneration potential at the interface and thus the clinical implant fixation. Compared to machined implant surfaces, the moderately rough surface (Fig. 2 - HENIAPORE-K”) of ADONIS® Exclusive exhibits denser bone apposition with significantly increased withdrawal force (removal load) and an extremely high coefficient of friction for primary stabilisation. This results in an accelerated osseointegration of these implants and the possibility of an earlier exposure.
General conditions for use

- We recommend that you do not use ADONIS® in combination with implants from another source or another manufacturer. HumanTech Germany GmbH shall not be liable if this recommendation is not followed.
- Never reuse the implants. Even if the implant appears to be intact following revision, alterations within the implant or minute defects resulting from the loading and stressing to which the implant has been subjected can cause the implant to break.
- Implants from the ADONIS® range have a limited useful life. The activities and physical activity of the patient have a significant influence on this useful life. Patients must be informed that every activity increases the risk of loss, bending or breakage of the implant components. Informing patients about limitations to their activities in the postoperative phase and postoperatively monitoring patients are crucial factors in assessing the development of the fusion and the condition of the implant. Even when permanent bone fusion has occurred implant components can still bend, break or loosen. Patients must therefore be informed that implant components may also bend, break or loosen even if they comply with the restriction in their activities.
- If an implant does break, the doctor must decide whether a revision of the implant should be performed, taking into account the well-being of the patient and the risks involved.
- The instructions in the Surgical Technique operation manual must be followed at all times.
- Proceed with extreme caution in the region of the spinal cord and the roots of the nerves, since damage to the nerves can lead to the impairment of neurological functions.
- Breakage, slippage or incorrect use of the instruments or implants can injure the patient or the operating staff.
- Do not use bone cement, as this material makes the removal of the components difficult or impossible. The heat produced by the hardening process can damage or deform the PEEK implants.
- Handle removed implants in such a way that their reuse is not possible.

- The PEEK and R-PEEK-Ti implants are supplied STERILE. They may be used only if the labels on the outer packaging and the inner packaging are intact. If the packaging is damaged or already open, the sterility of the implant is not guaranteed and the implant may not be used.
- The implants may not be used when the shelf life indicated has been exceeded.
- The implants may not be resterilised.
- Handle and store the implant components carefully. Damage to the implant can significantly reduce the strength and long-term stability of the implant system. Cracking and/or higher internal stresses can result, possibly resulting in the breakage of the implant.
- The implants and instruments should be stored at room temperature. Environmental factors, such as salt-laden air, humidity, chemicals etc., must not be allowed to act on the implants.
- Thorough inspection is recommended before operating in order to ensure that the instruments or implants have not been damaged during storage or previous procedures.