

Surgical Technique

T.L.I.F.®
Transforaminal Lumbar
Interbody Fusion

Featuring the
T.L.I.F. SG Instruments,
VG2® PLIF Allograft,
and the
MONARCH® Spine System.

C O N S U L T I N G S U R G E O N

Todd Albert, M.D.

Rothman Institute at Jefferson Hospital

925 Chestnut Street

Philadelphia, PA 19107-4216

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T.L.I.F.[®]
Transforaminal Lumbar
Interbody Fusion

INTRODUCTION

First described by Professor Jurgen Harms, the transforaminal lumbar interbody fusion (T.L.I.F.[®]) technique has gained wide acceptance in recent years.

An adaptation of the posterior lumbar interbody fusion (PLIF) technique first described by Cloward, the T.L.I.F. employs a unilateral approach to the disc space through the intervertebral foramen. In doing so, the T.L.I.F. procedure provides a single posterior approach to a “360°” fusion, with some inherent advantages compared to a PLIF.

Requiring only a partial unilateral facet resection, the T.L.I.F. preserves the laminar arch and contralateral facet, reducing the potential for compromise of the neighboring motion segments. Preservation of the contralateral facet also provides a revision strategy that may not exist with a PLIF due to bilateral scarring. Additionally, the T.L.I.F. procedure avoids the need for any significant dural retraction, minimizing peridural scarring and reducing the risk of intraoperative dural tears.

While the T.L.I.F. technique aims to reduce the potential complications associated with posterior interbody fusion procedures, it is certainly not without risks. Like any spinal procedure, the T.L.I.F. is a technically demanding operation that requires an intricate knowledge of the technique.

T.L.I.F.

Transforaminal Lumbar Interbody Fusion

S U R G I C A L T E C H N I Q U E

Step 1. Exposure

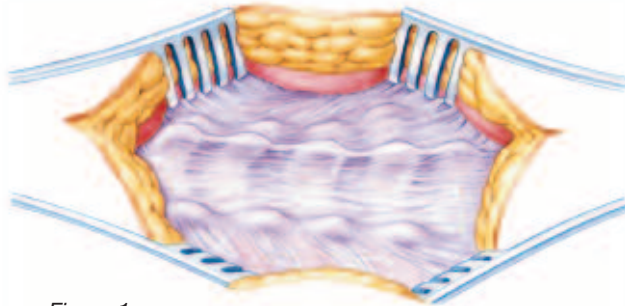


Figure 1

To access the L5/S1 disc space, incise the midline of the lumbar spine under general anesthesia and perform subperiosteal dissection of the musculature from the spinous processes. Bilateral dissection is carried out to the level of the transverse processes in the region of the intended fusion. Meticulously remove the musculature and the periosteum in the region of the segment to be fused.

Step 2. Facetectomy and Annulotomy

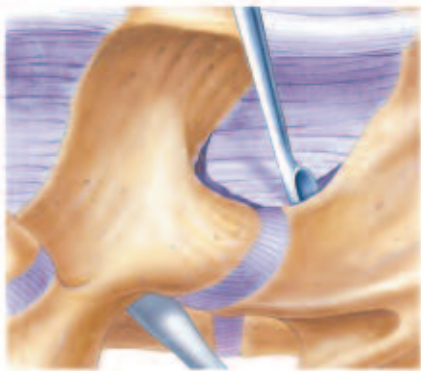


Figure 2a

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

- Reflect the ligamentum flavum from the anterior surface of the lamina with a curette (2a).
- Resect the inferior articular process of L5 with a Straight Osteotome (2b).

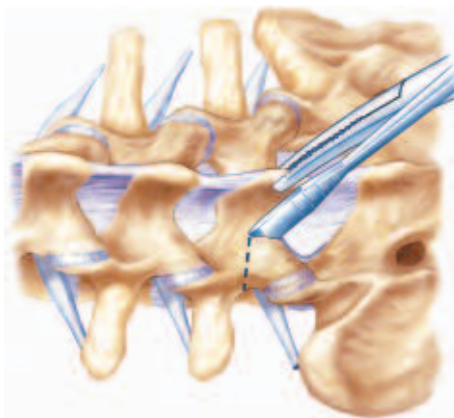


Figure 2b

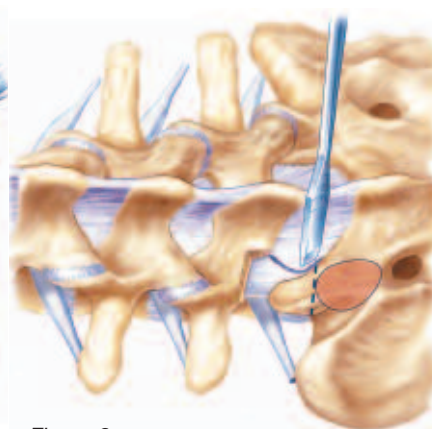


Figure 2c

- The capsular part of the ligamentum is now visible and can be resected.
- Resect the superior articular process of S1 with a Straight Osteotome to expose the intervertebral foramen (2c).

Step 2. *continued*

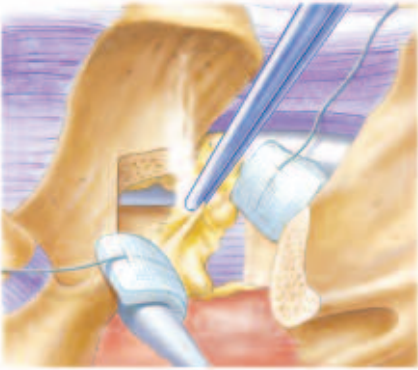


Figure 2d

- Skeletonize the S1 pedicle by removing the overhanging superior articular process with a Kerrison Punch to gain final access to the L5-S1 disc.
- Complete meticulous hemostasis at entry zone to disc space (2d).

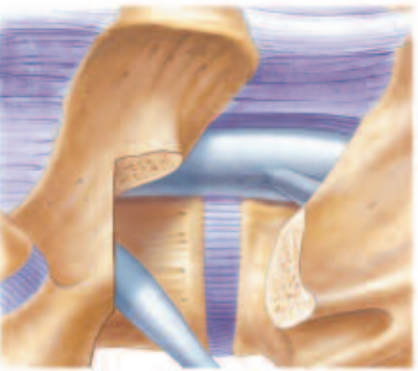


Figure 2e

- Be aware of the exiting nerve root and laterocranial part of the dural sac. A Dissector or Nerve Root Retractor may be used to ensure the protection of these structures at every step of the procedure (2e).



Figure 2f

- Perform a box annulotomy to create a window to the disc space (2f).

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Step 3. Initial Distraction of Disc Space

Initial distraction of the disc space may be necessary in order to gain access to the disc space for a complete discectomy.

- Using a Starter Dilator or Disc Spreader, open the disc space in preparation for a complete discectomy.
- A Starter Dilator is inserted horizontally into a collapsed disc space and then rotated 90 degrees to achieve distraction (3a).
- Alternatively, a Disc Spreader may be used in a similar fashion by inserting the Disc Spreader horizontally and rotating it 90 degrees (3b, 3c).

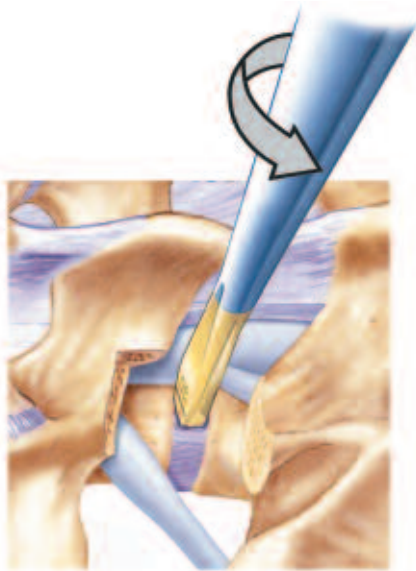


Figure 3a



Figure 3b

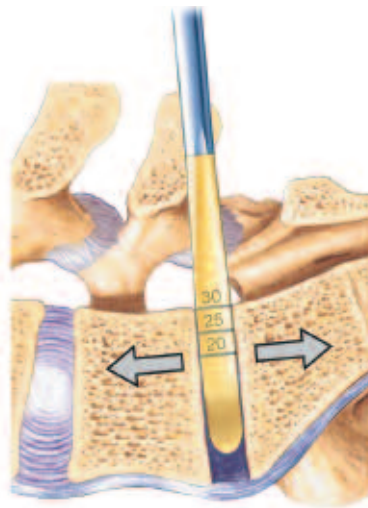


Figure 3c

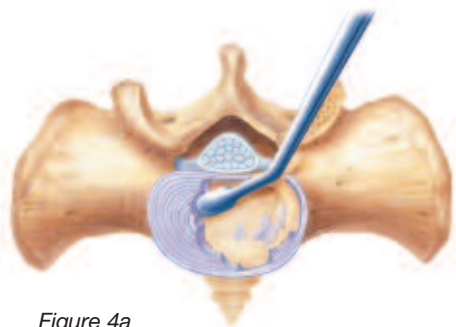


Figure 4a

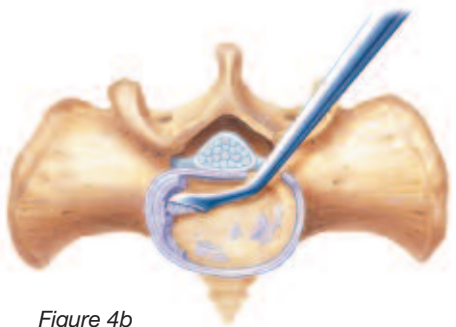


Figure 4b

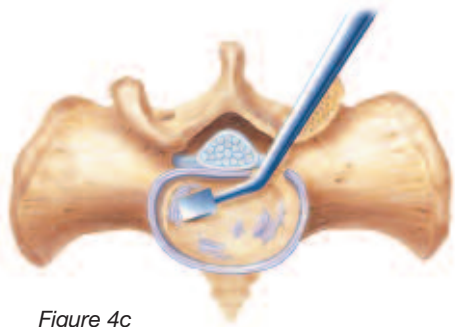


Figure 4c

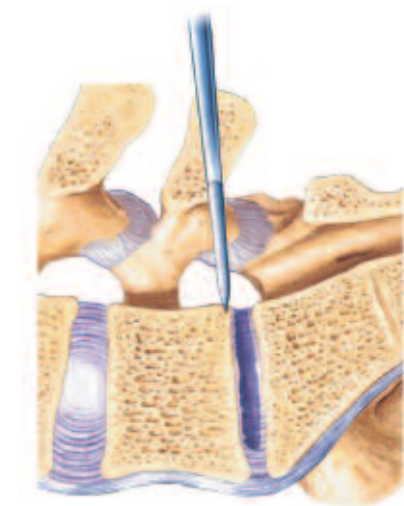


Figure 4d

Step 4. Disc Removal and Endplate Preparation

The unique lateral approach of the T.L.I.F. procedure requires specialized instruments to facilitate a complete discectomy. The techniques described allow the surgeon to effectively remove disc material and prepare the endplates on the contralateral side to the approach.

- While preserving the integrity of the endplates, perform a complete discectomy using a combination of Curettes, Chondrotomes, and Rongeurs.
- A variety of straight, angled, and offset Cup, Ring, and Down Biting Curettes are available to achieve complete disc removal.
 - Double angled Cup Curettes (Left & Right) can be used to remove disc from the contralateral side of the disc space, sequentially addressing the inferior and superior endplates (4a).
 - An Offset Down Biting Curette can effectively remove disc material from the contralateral posterior corner of the disc space by scraping in a dorsal – ventral fashion as shown in figure 4b.
- Chondrotomes are used in a scraping fashion to separate and remove any remaining disc and cartilage from the bony endplates (4c).
- A combination of Straight and Angled Rongeurs are then used to remove any loose disc material.
- Using a Straight Osteotome, resect the posterior lip of the superior and inferior endplates to make room for the interbody graft (4d). Due to the concavity of the endplates, this is an important step to both access the disc space and create flat parallel surfaces for the interbody device.

Note: When resecting the posterior lips, take care to preserve the integrity of the endplates.

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Step 5. Final Disc Space Distraction

Using a series of Interbody Disc Spreaders, it is necessary to distract the disc space in preparation for the interbody device.

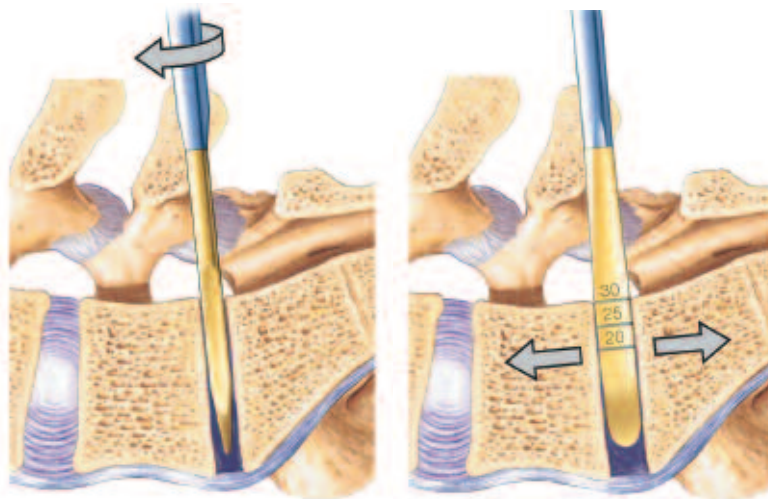


Figure 5a

Figure 5b

- Sequential Disc Spreaders are used to distract the disc space gradually until appropriate annular tension has been achieved and the size of the graft can be determined (5a, 5b).



Figure 6

Step 6. Placement of Bone Graft

In order to achieve a solid interbody arthrodesis, the disc space should be filled with as much cancellous autograft as possible.

- Fill the anterior third and contralateral side of the disc space with autogenous cancellous bone chips using a variety of Straight and Curved Bone Tamps.



Figure 7

Step 7. Implant Trial & Insertion

A single VG2® PLIF allograft spacer is then inserted into the disc space in an oblique fashion as shown in figure 7.

- Using a Trial spacer to determine the height and width, the appropriate size VG2 PLIF graft is selected.
- The VG2 PLIF graft is then gently tapped into the disc space with an impactor.

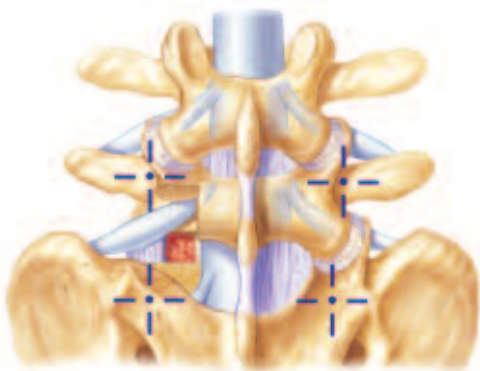


Figure 8a

Step 8. Screw Placement and Compression

Consult the MONARCH® Spinal System Surgical Technique for additional details

- Identify pedicle insertion points. The optimal insertion point is at the intersection of the transverse process and pars interarticularis (8a).



Figure 8b

- After cortical bone in this area is prepared with a burr or rongeur (8b), an awl and pedicle probe are used to create the pathway and trajectory for the pedicle screws (8c, 8d).

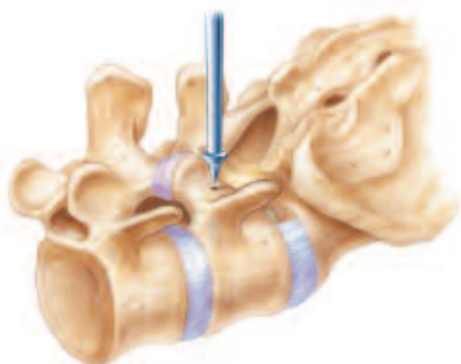


Figure 8c



Figure 8d

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Step 8. *continued*

- The pedicle is tapped according to size estimates (8e).



Figure 8e

- A sounding probe is used to confirm that the walls of the pedicle are still intact (8f).



Figure 8f

- MONARCH Polyaxial Screws are inserted and an optional x-ray is taken to verify their position (8g).

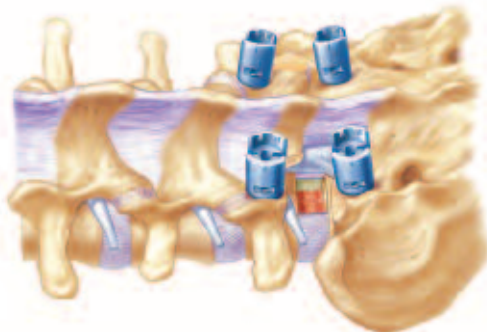


Figure 8g

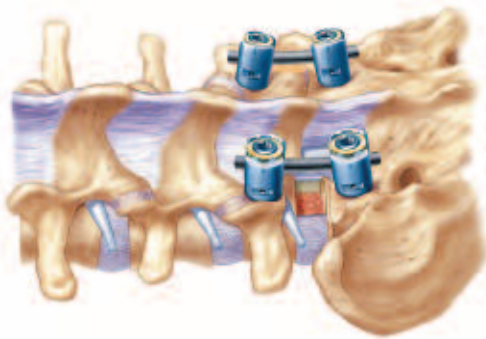


Figure 8h

- The appropriate length pre-cut or pre-lordosed rod is selected to match the appropriate lordosis of the patient's lumbar spine (8h).
- Rods are seated into the screw heads and captured by inserting the Typhoon Cap (8h).

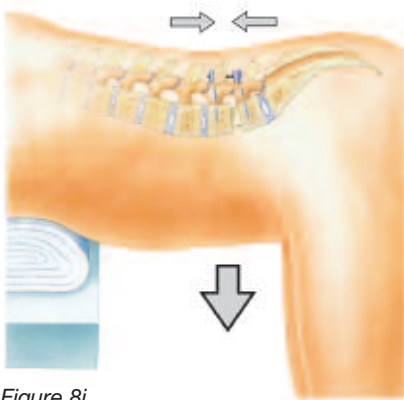


Figure 8i

- The dependent position of the abdomen shown in Figure 8i will apply an automatic compressive force to the implant.
- Active compression can also be applied to the MONARCH Screw System. To achieve this, tighten the caudal Typhoon set screws to securely lock the caudal screws in place and provide an anchor for the final compression.
- With the cephalad set screws loosened, use the compressor to perform final compression. Lock the compression in place by tightening the cephalad set screws.
- Revisit all screws for a final tightening.

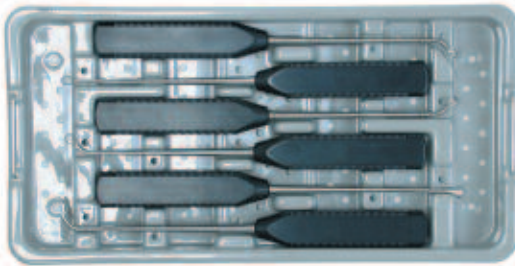
Note: It is important to preserve the facet above (L4/L5).

T.L.I.F.

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T.L.I.F. SG INSTRUMENTS

Curettes



2027-19-100 – T.L.I.F. SG Case & Trays



2027-11-003 – Cup, Left Angled
2027-11-004 – Cup, Right Angled
2027-11-005 – Cup, Left Up Angled
2027-11-006 – Cup, Right Up Angled



2027-11-107 – Ring, Angled
2027-11-103 – Ring, Left Angled
2027-11-104 – Ring, Right Angled
2027-11-105 – Ring, Left Up Angled
2027-11-106 – Ring, Right Up Angled



2731-30-003 – Downbiting, Straight
2027-11-301 – Downbiting, Offset



2027-11-001 – Cup, Straight
2027-11-002 – Cup, Up Angled

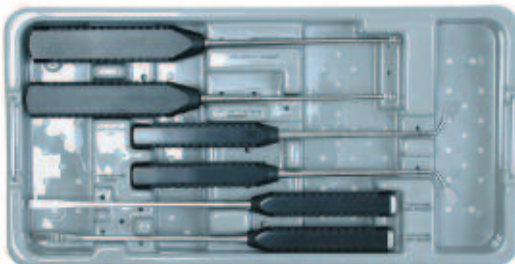


2027-11-101 – Ring, Straight
2027-11-102 – Ring, Up Angled



2027-11-201 – Rake, Straight
2027-11-203 – Rake, Left Angled
2027-11-204 – Rake, Right Angled

Osteotomes – Chondrotomes



2027-14-006 – 6mm Straight
2027-14-008 – 8mm Straight



2027-14-106 – 6mm Angled
2027-14-108 – 8mm Angled



2027-15-001 – Chondrotome, Left
2027-15-002 – Chondrotome, Right

Rongeurs – Bone Tamps – Dissectors – Nerve Root Retractor



2027-16-004 – Pituitary, 4mm Straight
2027-16-006 – Pituitary, 6mm Straight
2027-16-104 – Pituitary, 4mm Angled
2027-16-106 – Pituitary, 6mm Angled



2027-10-001 – Bone Tamp, Angled
2027-10-002 – Bone Tamp, Curved
2027-10-003 – Bone Tamp, Offset
2027-10-004 – Bone Tamp, Straight



2027-12-001 - Dissector
2027-12-002 – Dissector, Curved



2027-13-001 – Nerve Root Retractor

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INDICATIONS

The MONARCH® Spine System when used with pedicle screws is indicated for degenerative disc disease (defined as discogenic back pain with degeneration of the disc confirmed by history and radiographic studies). Levels of fixation are for the thoracic, lumbar and sacral spine.

The MONARCH Spine System when used with pedicle screws is indicated for degenerative spondylolisthesis with objective evidence of neurologic impairment, fracture, dislocation, scoliosis, kyphosis, spinal tumor, and failed previous fusion (pseudarthrosis). Levels of fixation are for the thoracic, lumbar and sacral spine.

The MONARCH Spine System is also indicated for pedicle screw fixation for Grade 3 and 4 spondylolisthesis at L5-S1, in skeletally mature patients, utilizing autologous bone graft, having the device fixed or attached to the lumbar or sacral spine and intended to be removed after solid fusion is attained. Levels of attachment for this indication range from L3 to the sacrum.

The MONARCH Spine System when not used with pedicle screws is intended for posterior hook, wire, and/or sacral/iliac screw fixation from T1 to the ilium/sacrum. The non-pedicle screw indications are spondylolisthesis, degenerative disc disease (defined as discogenic back pain with degeneration of the disc confirmed by history and radiographic studies), deformities (scoliosis, lordosis and kyphosis), tumor, fracture and previous failed fusion.

See the package insert for this product for complete warnings, precautions, and adverse events.

Notice: There are labeling limitations for the use of the MONARCH Spine System. See the package insert supplied with this device for important information.

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DePuy Spine, Inc.
325 Paramount Drive,
Raynham, MA 02767-0350