MANTIS Spinal System
Percutaneous System of the Xia Family
Surgical Technique
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Acknowledgments

Stryker Spine wishes to thank the MANTIS Surgeon Panel for their dedication to the development of the MANTIS Spinal System.

Hyun Bae, MD          Alan Hilibrand, MD
Kingsley Chin, MD      Reginald Knight, MD
Jeffrey Fischgrund, MD John Ratliff, MD
Jeffrey Henn, MD       Jeffrey Wang, MD

Introduction

One primary objective of Stryker Spine Less Invasive Technologies (LITe) is to replicate the clinical results of the corresponding open procedure.

At the moment there is insufficient data to show that minimally invasive spine surgery provides any short and long term benefit to patients when compared to traditional spine surgery.

Important

This Surgical Technique sets forth detailed, recommended procedures for using the MANTIS Spinal System. It offers guidance that you should heed but as with any such technical guide, each surgeon must consider the particular needs of each patient and make appropriate adjustments when necessary and as required.

Always refer to the package insert, product label and/or instructions before using any Stryker implant or instrument.

Note: No acid or alkaline solvents should be used in the cleaning of anodized components.

Note: Upon the completion of each surgical procedure, use adequate suction and irrigation to ensure the removal of any existing non-implantable materials.

Note: This is intended as a guide only. There are multiple techniques, and as with any surgical procedure, a surgeon should be thoroughly trained before proceeding.
**Key Design Features**

**True percutaneous approach**
- Stab incisions needed only for screw insertion

**Supports multi-level procedures**
- Scalable for degenerative and deformity applications

**Direct Visualization**
- Rod is seated under direct visualization

**Precise rod contouring before rod insertion**
- Allows rod bending to fit anatomy

**Un-constrained rod insertion**
- Rod insertion controlled by surgeon not system
**Patient Positioning**

MANTIS can be used under local, epidural, spinal or general anesthesia. General anesthesia is commonly used since it is the most comfortable for the patient and allows immediate postoperative neurological assessment.

> The patient is prepped and draped in the usual sterile manner for posterior fusion with pedicle Screw fixation.

**Surgical Procedures**

**Markings**

> Using A/P imaging, place the K-Wire (Sharp - 48230230, Blunt - 48230231) transversely across the mid-line of the cephalad pedicles.
> Repeat for the caudal pedicles.
Carefully determine the appropriate entry point and trajectory for the MANTIS Screw / Retractor Assembly.

> For pedicle Screws, the entry point is approximately 4cm off mid-line with a more lateral trajectory.
> Incise the fascia to make tissue dilation easier.

**Note:** If tissue dilation is difficult, increase the fascial incision.

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### K-Wire Insertion

> Insert the Jam Shidi 48237 (105), (110), (115), (135) through the skin incision to the intersection of the facet and transverse process.
> Confirm that the appropriate pedicle starting place has been determined using both A/P and lateral images.

**Note:** The Radius K-Wire is not compatible with the MANTIS Spinal System.

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> Use the Jam Shidi needle to gain access to the pedicle.
> After placing the Jam Shidi at the intersection of the facet and the transverse process, the needle may be advanced partially through the pedicle using the Slap Hammer (48237120).
As the pedicle is navigated with the Jam Shidi, it should approach the medial wall of the pedicle on the A/P view and should approach the base of the pedicle on the lateral view.

When the needle reaches the medial wall on the A/P view, verification needs to be performed in the lateral view to ensure the needle is past the base of the pedicle.
> Remove the inner trocar of the Jam Shidi.

> The removal of the Jam Shidi inner trocar allows the K-Wire to be inserted into the pedicle.

> Caution should be practiced with regard to the position of the K-Wire in order to avoid the advancement of the K-Wire.

Note: The K-Wire is 1.3mm in diameter.

Note: The K-Wire is a single use instrument.

Use the K-Wire Guide Tube (48230235) to prevent the K-Wire from bending or moving during insertion.

> Place the K-Wire Guide Tube over the K-Wire and dock on the Jam Shidi.

> Use the Slap Hammer to impact the K-Wire.
> Once the K-Wire is inserted, remove the outer shaft of the Jam Shidi.
> Hold the K-Wire in position when removing the Jam Shidi.

**Instrument Bar**

10 Gauge, 9 inch 48237110
10 Gauge, 5 inch 48237105
11 Gauge, 5 inch 48237115
13 Gauge, 5 inch 48237135

Jam Shidi

<table>
<thead>
<tr>
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<tr>
<td>Blunt</td>
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</table>

K-Wire

**48230235**

K-Wire Guide Tube

**48237120**

Slap Hammer
**Dilation**

> Place the Slim Dilator (48280105), over the K-Wire, through the incision.

> Advance the Slim Dilator, over the K-Wire, through the tissue twisting clockwise while directing it toward the pedicle.

> The Slim Dilator is advanced through the lumbodorsal fascia.

> Location of the Slim Dilator is confirmed using imaging.

**Note:** Feel, fluoroscopy, anatomical knowledge, review of preoperative images, and partial visualization may all contribute towards desired instrument placement accuracy.

**Note:** The depth marking of the Slim Dilator in relation to the skin.

The Dilators have depth markings (1, 2, 3, 4 and 5) laser etched which correlate to the Retractor Blade lengths.

Choose a **Retractor Blade** length 48281 (035), (057), (079), (911), (113) based on where the top of the skin meets the Dilator.

**Note:** If the skin is on the marking on the Dilator choose the next longest Blade; (i.e., depth marking is exactly “2” on the Dilator, use # 3 Retractor Blade).

> Sequentially slide the Dilator 2 (48280106), Dilator 3 (48280107) and the Hollow Dilator (48280102) over the Slim Dilator to sequentially penetrate and gently dissect soft tissue down to the pedicle. Twist the Dilators clockwise during insertion to engage the thread features.
> Remove the initial Dilators after inserting the **Hollow Dilator**.

> The **Hollow Dilator** remains in place as the working channel for pedicle preparation.
Pedicle Preparation

> With the Hollow Dilator still in place, prepare the pedicle by placing the Cannulated Modular Awl (48281164) over the K-Wire and impact into the pedicle with a twisting motion.

> Hold the K-Wire in position when removing the Awl.

> Use the cannulation of the Slap Hammer to impact the Awl.

Note: The Awl has a stop at 12.0mm.

Note: Cantilevering the Awl and the Taps while being in the pedicle may damage the instrument.

> If the bone is too hard, the appropriate Tap may be used to prepare the pedicle Screw canal.

> The Cannulated Modular Taps (4.5mm – 48281161, 5.5mm – 48281165, 6.5mm – 48281166, 7.5mm – 48281167) are calibrated with the Tap Sleeve (48281315) and laser etched with 5.0mm intervals to help indicate the depth at which the Tap has been inserted as well as to help determine proper Screw length.

Note: The length of the Taps’ thread is 25mm.

Note: The Cannulated Modular Taps are calibrated with the Tap Sleeve, not the Hollow Dilator.

> As an instrument advances into the pedicle, the proximal end of the instrument will move relative to the markings on the K-Wire. If this does not occur during insertion the procedure should be stopped and fluoroscopy should be used to verify the position of the K-Wire in relation to the Cannulated Modular Awl or Cannulated Modular Tap.

Note: 1.0cm interval markings on the K-Wire provide the cannulated instruments change in depth in the pedicle.
Check pedicle depth with either fluoroscopy or read the depth from the **Tap Sleeve** as it moves along the proximal edge of the **Tap Sleeve**. There are markings at 30, 40 and 50mm.

**Note:** The **Tap Sleeve** is made of radiolucent Ultem Poly Ether Imide.

**Note:** Slide the **Tap Sleeve** proximal to the **Tap** shaft to engage the friction fit. This prevents the **Tap Sleeve** from sliding off the **Tap**.

> Hold the **K-Wire** in position when removing the **Cannulated Modular Tap**.

The **Hollow Dilator** can now be removed. Hold the **K-Wire** in position when removing the **Hollow Dilator**.
**Screw / Retractor Assembly**

Assemble each pair of Retractor Blades into the MANTIS Screwhead.

1. Orient the Screw so that the tulip posts are pointing up.
2. Insert the appropriate size Retractor Blade into each side of the tulip posts and spread apart.

**Note:** Retractor Blade size is chosen from the measurement taken from the Dilator.

**Note:** There are two types of Blades available. The Stainless Steel Reduction Blades and the Aluminum Retractor Blades. The Aluminum Blades are radiolucent and should be used as single use instrument.

3. Orient the Slim Ring (48281201) with the flat side down.
4. Insert the Retractor Blades through the bottom of the Sliding Ring.
5. Slide the Sliding Ring past the “stops” of the Retractor Blades.
6. Repeat this procedure for each MANTIS Screw.

**Note:** The Retractor Blades and Slim Ring are reposable aluminum instruments and therefore may need to be replenished after a few uses.
Screw Insertion

With the pedicle pathways prepared and proper Screw length and diameter determined, the MANTIS Screw is prepared for insertion.

The MANTIS Screwdriver (48281310) provides a very rigid connection between the MANTIS Screw and Screwdriver. The Screwdriver can be attached to any of the cannulated modular handles (T Ratchet - 48231200; Round Ratchet - 48231300; T Non-Ratchet - 48231205; Round Non-Ratchet - 48231305) using the quick release mechanism.
> Place a MANTIS Screw on the distal end of the Screwdriver and lock into place.

> Place the MANTIS Screw over the K-Wire and insert into the pedicle.

> After driving the Screw Assembly into the pedicle, remove the K-Wire to prevent it from advancing.

> Be certain that the Screw Assembly is not inserted too far. If the polyaxial head of the MANTIS Screw is driven too forcefully against bone, it will lose its polyaxial capabilities making it difficult to connect the assemblies during subsequent steps.

Note: Use imaging and monitoring, as preferred, for added information during bone Screw insertion.

> Detach and remove Screwdriver from the Screw.

Note: The orientation of the Slim Ring can be changed after removal of the Screwdriver.

> Repeat the process for additional Screws.
Screw Alignment

> Insert the Rod Contouring Shafts (48284030) into the Screw / Retractor Assembly. The Rod Contouring Shafts should be firmly seated into the Screwheads.

Note: The laser markings on the Rod Contouring Shafts correspond to the Retractor Blades to indicate that the shafts are properly seated.

Note: It is recommended to use the Rod Contouring Shafts when manipulating the Screwheads.

Note: The polyaxial bone Screws may provisionally lock upon insertion. With the Rod Contouring Shafts in place, rotate the Retractor Blades to unlock the heads before introducing the Rod.
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**Screw Adjustment**

> The Screw heights may be adjusted as needed using the MANTIS Poly Adjustment Driver (48287033). Use fluoroscopic images to confirm.

> The Poly Adjustment Driver can be inserted through the cannulas of the Rod Contouring Shafts.

![Figure 30](image)

**Rod Selection**

> Align the Rod Contouring Shafts so that they are parallel.

> Attach the Rod Contouring Linkage (48284035) to the Rod Contouring Shafts. As needed, attach additional Rod Contouring Linkages to the remaining Rod Contouring Shafts alternating sides.

![Figure 31](image)

> Lock the Rod Contouring Linkages into place by twisting the wing nut clockwise. The indicator should be flush on top.

**Note:** By locking the Rod Contouring Shafts in parallel, the top of the shafts reproduce the relative spacing of the Screwheads above the skin.

**Note:** If the distance between Rod Contouring Shafts is too great, use the Extended Rod Contouring Linkage (48284036).

![Figure 32](image)
Rod Insertion

> The MANTIS Spinal System offers a comprehensive selection of Rods and Rod Inserters. The MANTIS Hex End Rods provide a rigid connection between the Rod and Rod Inserter for easy insertion and manipulation.

There are two types of Rod Inserters available:

- 90 degree fixed Rod Inserter (48480091)
- 110 degree fixed Rod Inserter (48480111)

> Insert the Rod Inserter Shaft into the Rod Inserter.

> Choose the appropriate MANTIS Rod and desired Rod Inserter (48480091 or 48480111). Attach the appropriate Rod to the Rod Inserter that has a groove in the handle. Lock the Rod into position by twisting clockwise the knob on the proximal end of the Rod Inserter.

**Note:** The MANTIS Hex End Rods are laser marked with a dotted line to indicate their orientation. Ensure that the line is facing up when attached to the Rod Inserter.

> Lock the Rod into position by twisting the knob on the handle clockwise.

**Figure 33**

**Figure 34**

**Note:** The Rod Inserter should be disassembled before cleaning. To disassemble, press the button on the handle and rotate the knob counter-clockwise.
> Insert the Rod percutaneously from either the cephalad or caudal side through the Retractor Blades. Guide the Rod through each pair of Retractor Blades.

Note: The Rod is to be inserted from the open side of the Slim Ring.

Note: Ensure that the Rod overhangs the distal screw head.

> The Rod Gripper (48284055) may be used for adjustment of the Rod.
> Insert the Rod Gripper down the Retractor Blades. Squeeze the handle to engage the Rod.
> Manipulate the Rod as needed.
**Blocker Insertion**

> Insert the Universal Tightener (03807008) into the Blocker (4828999).

> Use the Counter Torque Tube (48284080) as an insertion tube to facilitate alignment of the Blocker with the tulip and to prevent cross-threading.

**Note:** The laser markings on the Counter Torque Tube correspond to the Retractor Blades to indicate that the Counter Torque Tube is properly seated.

> Slide the Universal Tightener and Blocker through the Screw / Retractor Assembly and secure it in the tulip head of the Screw.

**Note:** It is recommended to insert the most distal Blocker first.

> Rotate the Blocker clockwise to seat the Blocker.

> Repeat for other bone Screws.

**Note:** The Universal Tightener is not intended to be used for final tightening.
MANTIS
Surgical Technique

> Once the Rod is sufficiently captured in the Screws, detach the Rod Inserter from the Rod by turning the knob on the Rod Inserter in a counter clockwise direction.

Note: There is a mechanical stop to indicate that the Rod Inserter is fully engaged.

Note: The Rod Inserter is to be removed along the axis of the Rod.

Rod Reduction

The MANTIS Persuader can be used when additional force is needed to bring the rod to the implant.

If Aluminum Retractor Blades are being used, they must be exchanged for Reduction Blades in order to use the persuader. The MANTIS Persuader is only compatible with the Stainless Steel Reduction Blades.

Exchanging Blades

The Blade Exchanger set can be used to change the blades at any time. There are two Blade Exchanger Inserts, With (48280076) and Without (48280077) Rod. For this technique it is assumed that there is a rod located in the screwhead.
> Slide the Blade Exchanger Insert down the Retractor Blades and into the screw head. Ensure that the Blade Exchanger Insert is fully seated.

> With the Blade Exchanger Insert seated in the screwhead, remove the Slim Ring.
> With the Slim Ring removed, pinch the Retractor Blades together and lift up to remove.

Figure 44

> With the Blades removed and the Blade Exchanger Insert seated, slide the Blade Exchanger (48280075) over the Blade Exchanger Insert. Ensure that the Blade Exchanger is fully seated.

Figure 45

> Slide the Blade Exchanger Guide (48282078) over the Blade Exchanger. Ensure that the correct side is up.

Figure 46
> Insert the **Reduction Blades** into the slits on the side of the **Blade Exchanger Guide**.

> Use the **Blade Pusher** *(48280079)* to slide the blades down the guide until they clip into place.
> Remove the Blade Exchanger Guide. Care should be taken not to remove the Blade Exchanger or Reduction Blades.

> Use the Blade Exchanger as a guide to reattach the Slim Ring.

> Remove the Blade Exchanger.
The MANTIS Persuader can be used when additional force is needed to bring the rod to the implant.

The MANTIS Persuader set has three components:
- Persuader (48284065)
- Persuader Shaft (48284066)
- Blocker Inserter (48287008)

> To assemble the MANTIS Persuader, insert the Persuader Shaft into the Persuader.

> Depress the gold button to slide the Persuader Shaft into place.

Note: It is important to lubricate the Persuader with instrument milk prior to use. Areas to lubricate are oblonged holes, teeth on ratchet, slides, and shaft set.

> Slide the Persuader Shaft to the appropriate Retractor Blade length.
> The **Persuader** is then pressed onto the **Reduction Blades** of the appropriate screw and snapped into place.

**Note:** Only Stainless Steel **Reduction Blades** can be used with the **Persuader**.

> Squeeze the lever to perform the desired reduction maneuver.

**Note:** The **MANTIS Persuader** offers 20mm of reduction capability.

> Insert the **Blocker** using the **MANTIS Blocker Inserter**.

**Note:** The **Xia Universal Tightener** is too short to be used with the **MANTIS Persuader**.
> To remove, squeeze the flanges on the Persuader and lift.

> Press the button on the handle to return the Persuader to the neutral position.

> Ensure that this instrument is disassembled and cleaned separately.

> This instrument should be properly lubricated between use.
Compression and Distraction

> To achieve compression and distraction, insert the Compression & Distraction Shaft (48284077) and Compression & Distraction Hinge (48284078) through the Screw/Retractor Assembly and secure them into the tulip head of the Screws.

> Note the laser marking on the shafts to ensure that the shafts are fully seated.

**Note:** The Compression & Distraction Shaft and Hinge are to be oriented so that the eyelets are located on the outside.

> Mate the tops of the Compression & Distraction Shaft and Hinge using the connecting feature.

> To distract, insert the Distractor (48284070) into the eyelets of the Compression & Distraction Shaft and Hinge. Squeeze the Distractor to apply the appropriate distraction.
To compress, insert the Compressor (48284075) into the eyelets of the Compression & Distraction Shaft and Hinge. Squeeze the Compressor to apply the appropriate compression.

Note: The Compression & Distraction Shaft and Hinge are cannulated to allow for Blocker introduction.
Construct Tightening

> Once the correction procedures have been carried out and the spine is fixed in a satisfactory position, the final tightening of the Blocker is done by utilizing the Counter Torque Tube (48284080) and the Torque Wrench (03807028).

> Dock the Counter Torque Tube on the Screw.

Note: Note the depth markings on the Counter Torque Tube to ensure that it is fully engaged with the Screw.

> Insert the Torque Wrench into the Counter Torque Tube to engage the Blocker.

> Line up the two arrows on the Torque Wrench to achieve the best possible torque of 12Nm for final tightening of the implants.

Note: The Counter Torque Tube must be used for final tightening. The Counter Torque Tube performs two important functions:

1. It allows the Torque Wrench to align with the axis of the tightening axis.

2. It allows one to apply the torque needed to lock the implant assembly without applying the torque to the rest of the construct.

Note: If the Counter Torque Tube cannot be easily removed from the implant head, the Rod may not be fully seated.

Blade Removal

> Remove the Slim Ring from the Retractor / Reduction Blades by pulling up.
> Pinch one Retractor / Reduction Blades over to the other and remove it by pulling up.
> Remove the other Blade by tilting it to the other side and pulling up.

### Closure

> Examine the site for bleeding.

> If accessible, close the fascia with one or two interrupted sutures. The subcutaneous tissue is closed in an inverted manner. A subcuticular closure is performed. Cover the skin edge with clear waterproof dressing.
### Instrument Bar

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<th>3-5cm</th>
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**Reduction Blade**
## Catalog Information

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#### Dilatation

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## MANTIS Surgical Technique

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<td>482854(25) – (45)</td>
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Removal or Revision Procedures

These implants are temporary internal fixation devices designed to stabilize the operative site during the normal healing process. After healing occurs, these devices usually serve no functional purpose and can be removed. Removal may also be recommended in other cases, such as:

> Corrosion with a painful reaction
> Migration of the implant, with subsequent pain and/or neurological, articular or soft tissue lesions
> Pain or abnormal sensations due to the presence of the implants
> Infection or inflammatory reactions
> Reduction in bone density due to the different distribution of mechanical and physiological stresses and strains
> Failure or mobilization of the implant

Standard ancillaries provided by Stryker Spine can be used to remove the implants.

Any decision by a physician to remove the internal fixation device must take into consideration such factors as the risk to the patient of the additional surgical procedure as well as the difficulty of removal. Removal of an unloosened spinal screw may require the use of special instruments to disrupt the interface at the implant surface. This technique may require practice in the laboratory before being attempted clinically. Implant removal should be followed by adequate postoperative management to avoid fracture or re-fracture. Removal of the implant after fracture healing is recommended. Metallic implants can loosen, bend, fracture, corrode, migrate, cause pain or stress shield bone.

Indications & Contraindications

Indications

MANTIS Spinal System

The MANTIS Spinal System is intended for percutaneous posterior, noncervical pedicle fixation for the following indications: degenerative disc disease (defined as back pain of discogenic origin with degeneration of the disc confirmed by history and radiographic studies), spondylolisthesis, trauma (i.e., fracture or dislocation), spinal stenosis, curvatures (i.e., scoliosis, kyphosis, and/or lordosis), tumor, pseudoarthrosis and failed previous fusion.

Contraindications

Contraindications may be relative or absolute. The choice of a particular device must be carefully weighed against the patient’s overall evaluation. Circumstances listed below may reduce the chances of a successful outcome:

> Any abnormality present which affects the normal process of bone remodeling including, but not limited to, severe osteoporosis involving the spine, bone absorption, osteopenia, primary or metastatic tumors involving the spine, active infection at the site or certain metabolic disorders affecting osteogenesis.
> Insufficient quality or quantity of bone which would inhibit rigid device fixation.
> Previous history of infection.
> Excessive local inflammation.
> Open wounds.
Any neuromuscular deficit which places an unusually heavy load on the device during the healing period.

> Obesity. An overweight or obese patient can produce loads on the spinal system which can lead to failure of the fixation of the device or to failure of the device itself.

> Patients having inadequate tissue coverage of the operative site.

> Pregnancy.

> A condition of senility, mental illness, or substance abuse. These conditions, among others, may cause the patient to ignore certain necessary limitations and precautions in the use of the implant, leading to failure or other complications.

> Foreign body sensitivity. Where material sensitivity is suspected, appropriate tests should be made prior to material selection or implantation.

> Other medical or surgical conditions which would preclude the potential benefit of spinal implant surgery, such as the presence of tumors, congenital abnormalities, elevation of sedimentation rate unexplained by other diseases, elevation of white blood cell count (WBC), or marked left shift in the WBC differential count.

> These contraindications can be relative or absolute and must be taken into account by the physician when making his decision. The above list is not exhaustive.

Surgeons should warn patients of the above listed potential adverse effects, including the finite service life of the device and the need for post-operative protection of the implant.

### Caution & Warnings

#### General Conditions of Use

The implantation of pedicle screw spinal systems must be performed only by experienced spinal surgeons having undergone the necessary specific training in the use of such systems because this is a technically demanding procedure presenting a risk of serious injury to the patient.

The information contained in the Package Insert is necessary but not sufficient for the use of this device. This information is in no sense intended as a substitute for the professional judgment, skill and experience of the surgeon in careful patient selection, preoperative planning and device selection, knowledge of the anatomy and biomechanics of the spine, understanding of the materials and the mechanical characteristics of the implants used, training and skill in spinal surgery and the use of associated instruments for implantation, securing the patient’s cooperation in following an appropriately defined post-operative management program and conducting scheduled post-operative follow-up examinations.

The Mantis System has not been tested for heating or migration in the MR environment.

#### Information for Patients

The surgeon must discuss all physical and psychological limitations inherent to the use of the device with the patient. This includes the rehabilitation regimen, physical therapy, and wearing an appropriate orthosis as prescribed by the physician. Particular discussion must be directed to the issues of premature weight bearing, activity levels, and the necessity for periodic medical follow-up.

The surgeon must warn the patient of the surgical risks and made aware of possible adverse effects. The surgeon must warn the patient that the device cannot and does not replicate the flexibility, strength, reliability or durability of normal healthy bone, that the implant can break or become damaged as a result of strenuous activity or trauma, and that the device may need to be replaced in the future. If the patient is involved in an occupation or activity which applies inordinate stress upon the implant (e.g., substantial walking, running, lifting, or muscle strain) the surgeon must advise the patient that resultant forces can cause failure of the device. Patients who smoke have
been shown to have an increased incidence of non-unions. Surgeons must advise patients of this fact and warn of the potential consequences. For diseased patients with degenerative disease, the progression of degenerative disease may be so advanced at the time of implantation that it may substantially decrease the expected useful life of the appliance. In such cases, orthopaedic devices may be considered only as a delaying technique or to provide temporary relief.

Infection

Transient bacteremia can occur in daily life. Dental manipulation, endoscopic examination and other minor surgical procedures have been associated with transient bacteremia. To help prevent infection at the implant site, it is advisable to use antibiotic prophylaxis before and after such procedures.

Implant Selection and Use

The choice of proper shape, size and design of the implant for each patient is crucial to the success of the surgery. The surgeon is responsible for this choice which depends on each patient.

Patients who are overweight may be responsible for additional stresses and strains on the device which can speed up metal fatigue and/or lead to deformation or failure of the implants.

The size and shape of the bone structures determine the size, shape and type of the implants. Once implanted, the implants are subjected to stresses and strains. These repeated stresses on the implants should be taken into consideration by the surgeon at the time of the choice of the implant, during implantation as well as in the post-operative follow-up period. Indeed, the stresses and strains on the implants may cause metal fatigue or fracture or deformation of the implants, before the bone graft has become completely consolidated. This may result in further side effects or necessitate the early removal of the osteosynthesis device.

Improper selection, placement, positioning and fixation of these devices may result in unusual stress conditions reducing the service life of the implant. Contouring or bending of rods or plates is recommended only if necessary according to the surgical technique of each system. Rods or plates should only be contoured with the proper contouring instruments. Incorrectly contoured rods/plates, or rods/plates which have been repeatedly or excessively contoured must not be implanted. The surgeon is to be thoroughly familiar with the surgical procedure, instruments and implant characteristics prior to performing surgery. Refer to the Stryker Spine surgical protocols for additional procedural information. Periodic follow-up is recommended to monitor the position and state of the implants, as well as the condition of the adjoining bone.

Post-Operative Care

Prior to adequate maturation of the fusion mass, implanted spinal instrumentation may need additional help to accommodate full load bearing. External support may be recommended by the physician from two to four months postoperatively or until x-rays or other procedures confirm adequate maturation of the fusion mass; external immobilization by bracing or casting be employed. Surgeons must instruct patients regarding appropriate and restricted activities during consolidation and maturation for the fusion mass in order to prevent placing excessive stress on the implants which may lead to fixation or implant failure and accompanying clinical problems. Surgeons must instruct patients to report any unusual changes of the operative site to his/her physician. The physician should closely monitor the patient if a change at the site has been detected.

Adverse Effects

> While the expected life of spinal implant components is difficult to estimate, it is finite. These components are made of foreign materials which are placed within the body for the potential
fusion of the spine and reduction of pain. However, due to the many biological, mechanical and physicochemical factors which affect these devices but cannot be evaluated in vivo, the components cannot be expected to indefinitely withstand the activity level and loads of normal healthy bone.

> Bending, disassembly or fracture of any or all implant components.
> Fatigue fracture of spinal fixation devices, including screws and rods, has occurred.
> Pain, discomfort, or abnormal sensations due to the presence of the device.
> Pressure on skin from components where inadequate tissue coverage exists over the implant, with the potential extrusion through the skin.
> Dural leak requiring surgical repair.
> Loss of proper spinal curvature, correction, height and/or reduction.
> Delayed Union or Nonunion: Internal fixation appliances are load sharing devices which are used to obtain alignment until normal healing occurs. In the event that healing is delayed, does not occur, or failure to immobilize the delayed/nonunion results, the implant will be subject to excessive and repeated stresses which can eventually cause loosening, bending or fatigue fracture. The degree of success of union, loads produced by weight bearing, and activity levels will, among other conditions, dictate the longevity of the implant. If a nonunion develops or if the implants loosen, bend or break, the device(s) should be revised or removed immediately before serious injury occurs.
> Loosening of spinal fixation implants can occur. Early mechanical loosening may result from inadequate initial fixation, latent infection, premature loading of the prosthesis or trauma. Late loosening may result from trauma, infection, biological complications or mechanical problems, with the subsequent possibility of bone erosion, migration and/or pain.
> Peripheral neuropathies, nerve damage, heterotopic bone formation and neurovascular compromise, including paralysis, loss of bowel or bladder function, or foot-drop may occur.
> Serious complications may be associated with any spinal surgery. These complications include, but are not limited to: genitourinary disorders; gastrointestinal disorders; vascular disorders, including thrombus; bronchopulmonary disorders, including emboli; bursitis, hemorrhage, myocardial infarction, infection, paralysis or death.
> Neurological, vascular, or soft tissue damage due directly to the unstable nature of the fracture, or to surgical trauma.
> Inappropriate or improper surgical placement of this device may cause distraction or stress shielding of the graft or fusion mass. This may contribute to failure of an adequate fusion mass to form.
> Decrease in bone density due to stress shielding.
> Intraoperative fissure, fracture, or perforation of the spine can occur due to implantation of the components. Postoperative fracture of bone graft, the intervertebral body, pedicle, and/or sacrum above and/or below the level of surgery can occur due to trauma, the presence of defects, or poor bone stock.

Adverse effects may necessitate reoperation or revision.

**Pre-operative Precautions**

Anyone using Stryker Spine products can obtain a Surgical Technique brochure by requesting one from your local Stryker Spine representative. Those using brochures published more than two years before the surgical intervention are advised to get an updated version.
Stryker Spine devices can only be used by doctors who are fully familiar with the surgical technique required and who have been trained to this end. The doctor operating must take care not to use the instruments to exert inappropriate stress on the spine or the implants and must scrupulously comply with any operating procedure described in the surgical technique provided by Stryker Spine. For example, the forces exerted when repositioning an instrument in-situ must not be excessive as this is likely to cause injury to the patient.

To reduce the risks of breakage, care must be taken not to distort the implants or nick, hit or score them with the instruments unless otherwise specified by the applicable Stryker Spine Surgical Technique.

Extreme care must be taken when the instruments are used near vital organs, nerves or vessels.

Unless otherwise specified on the label, the instruments can be reused after decontamination, cleaning and sterilization.

**Caution**

Federal law (USA) restricts this device to sale by or on the order of a licensed physician.
Simple Way to Strong Support

Spinal Systems of the Xia Family:
Modern Solutions for All Your Applications

This document is intended solely for the use of healthcare professionals.

A surgeon must always rely on his or her own professional clinical judgment when deciding whether to use a particular product when treating a particular patient. Stryker does not dispense medical advice and recommends that surgeons be fully trained in the use of any particular product before using it in surgery.

The information presented herein is intended to demonstrate the breadth of Stryker product offerings. A surgeon must always refer to the package insert, product label and/or instructions for use before using any Stryker product.

Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your Stryker representative if you have questions about the availability of Stryker products in your area.

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