# Aesculap<sup>®</sup> S<sup>4®</sup> Spinal System SRI

Spondylolisthesis Reduction Instrument Surgical Technique



Aesculap Spine



# S<sup>4®</sup> Spinal System



#### Small

The S<sup>4</sup> Spinal System features a revolutionary pressure vessel design capable of delivering unmatched biomechanical stability while maintaining an exceptionally small implant volume. This low profile, low volume aspect of S<sup>4</sup> reduces the risk of facet and soft tissue impingement which ultimately leads to better mechanical stability and reduced soft tissue irritation. S<sup>4</sup> also features an inner Set Screw for locking the construct which greatly improves distraction and compression maneuvers and guarantees a "low run on the rod" throughout all implant components.

## Stable

The S<sup>4</sup> Spinal System features a unique closure mechanism that maximizes surface contact area which effortlessly stabilizes the whole construct and ensures a high overall biomechanical strength.

In addition, the interconnection strength between the bone screw and body is extremely stable due to a special shaped seat inside the body which creates the revolutionary pressure vessel that efficiently transfers force through out the rod-screw construct.

Lateral stability can also be achieved with S<sup>4</sup> using the various rigid and adjustable cross-connectors!

## S<sup>4</sup> Spinal System

From initial conception, the S<sup>4</sup> Spinal System was developed to meet the spine surgeon's need for an extremely low profile and incredibly stable thoracolumbar spinal fixation system. By combining the exceptionally small yet stable design of the screw construct with simple instrumentation, the S<sup>4</sup> Spinal System emerges as a remarkably safe system for posterior column fixation.

The development elements – small, stable, simple, and safe – define the S<sup>4</sup> Spinal System as the state-of-the-art pedicle fixation system of choice for surgeons requiring performance oriented top-loading pedicle screw systems!

#### Simple

S<sup>4</sup> instruments were designed to meet the surgeons demand for a quicker yet simpler surgical procedure.

The multiaxial capability of the polyaxial screws provide 42° total range of motion, which allows for easier rod placement. The small implant volume greatly improves distraction and compression maneuvers, especially in narrow conditions, and enhances the surgeon's ability to place interbody fusion spacers when distracting off pedicle screws.

By combining the S<sup>4</sup> Spinal System with the ProSpace interbody fusion spacers, Aesculap offers a true three-column stabilization portfolio, capable of providing the surgeon all it takes to operate in spine surgery!

#### Safe

The top-loading, inner Set Screw of S<sup>4</sup> features an exclusive undercut thread design that virtually eliminates cross threading. This unique undercut thread actually directs the forces inward to prevent splaying of the body, which ultimately results in improved force transmission and efficiency throughout the rod screw construct.

The small volume and low profile design of the S<sup>4</sup> implant also minimizes interference with anatomical structures thereby allowing the surgeon the ability to remove less facet joint!

# S<sup>4®</sup> SRI



## Main Advantages of the S<sup>4</sup> SRI:

- The unique design of the S<sup>4</sup> SRI facilitates simultaneous correction of translation and slip angle.
- Allows reduction with single-level fusion, sparing adjacent healthy vertebra.
- Reduces the listhetic vertebral body along the same curved displacement route, minimizing interference with anatomical structures and eliminating neurologic deficits that typically result from initial over-distraction of an already stretched nerve root.
- Enables simultaneous reduction and distraction making it easier to use while reducing overall procedure time.
- Reduction maneuver is precise and controlled, reducing risk of inadvertent (unwanted potentially damaging) movements.





A safe reduction utilizing Aesculap's spondylolisthesis reduction instrument and the S $^4$  Spinal System with TLIF.









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## Preparation



## A.1.1 Screw Placement and Selection

- Within the limits of the patient's anatomy, the screws in the cephalad vertebral body are best placed parallel to its superior endplate and as parallel to each other as possible. Place the caudal vertebra screws so that they are parallel to the cephalad vertebra screws in both planes (as compared to the standard convergent manner). Placement of screws in this way allows for optimal operation of the reduction instrument and provides for easier rod placement.
- Polyaxial screws should be used in the cephalad vertebra to be repositioned and monoaxial screws should be used in the caudal vertebral body. In the case of an L5/S1 reduction, the chosen length at S1 should achieve bi-cortical purchase.



## A.1.2 S<sup>4</sup> SRI – Application and Use

The instrument has two components: a right and a left one. Each component has two pedicle screw attachments: one attaches to the cephalad vertebral screw that will be repositioned, and the other to the caudal vertebral screw.

## A.1.3 Prior to Attaching the Instrument

- On the caudal components, make sure the distraction nuts are at a point of minimal distraction (toward the most caudal position of the S<sup>4</sup> SRI).
- Also, on the caudal components, make sure the reduction bolts are backed out to the point of minimal reduction.



## **Application and Use**



## A.2.1 Attaching the Instrument to the Pedicle Screws

- Attach the cephalad component first. Insert the mounting post into the tulip of the screw and finger tighten.
- Ensure that the articulated head is positioned inferiorly and insert the distraction spindle (caudal component) into the articulated head of the cephalad component. At the same time, insert the mounting post into the tulip of the pedicle screw of the caudal vertebra and finger tighten.
- Once the instrument is attached and positioned properly tighten the caudal and cephalad components using the T-handles. Hold the smaller inner T-handle (FW232R) and use it to apply counter torque while tightening with the larger outer T-handle (FW231R). The mounting post on polyaxial screws should be tightened enough to lock the polyaxial head. The mounting post on monoaxial screws need to be tightened enough to cover the break-off tabs and part of the screw head.



The caudal components are labeled "R" for right and "L" for left. Following this labeling leads to lateral placement of the reduction instruments. Alternatively, the devices can be placed medially to the

pedicle screws by putting the right on the left and the left on the right.

#### Note:

Medial placement of the reduction instrument is the preferred method because it usually allows for easier reduction and less soft tissue impingement from the device itself. Lateral placement sometimes allows an easier interbody placement, but can make the reduction maneuver more difficult. In order to avoid breaking of the tab during reduction, make sure to fully tighten the SRI device to the pedicle screw prior to performing the reduction.





## **Application and Use**



## A.3.1 Distraction

Using the S<sup>4</sup> distraction forceps (FW181R – located in the S<sup>4</sup> Spinal System set) slowly spread the S<sup>4</sup> SRI device to achieve the desired distraction and then lock the distraction in place with the distraction nut on the threaded distraction spindle.

## A.3.2 The Reduction Process

- Using the large outer T-handle (FW231R) on the reduction bolt, turn clockwise to carefully reduce the spondylolisthesis under C-arm control.
- Best results are usually achieved by one or two turns of the reduction bolt on alternating sides.
- Monitor the nerve root tension during reduction typically, a decrease in the nerve root tension will be observed.



## A.3.3 Interbody Implant and Rod Placement

- Using the T-handles and applying counter torque as described in the tightening procedure on page 10, remove the S<sup>4</sup> SRI from one side (if required to provide room to work) and perform a routine TLIF or PLIF with the Aesculap ProSpace or T-Space interbody fusion implant systems.
- If the S<sup>4</sup> SRI was not removed from one side during the previous step, remove one side.
- Place the S<sup>4</sup> rod, and then lock in place with the set screws as described in the S<sup>4</sup> Spinal System Surgical Technique.
- Repeat on the contralateral side.





## Instruments



## **B.1 Basic Instruments**

Article No.	Component	Basic	Optional
FW225R	Reduction instrument, left and right incl. 2 reduction levers	1	
FW231R	Outer T-handle for S <sup>4</sup> SRI locking sleeve	2	
FW232R	Inner T-handle for S <sup>4</sup> SRI screw attachment	2	



## B.2 Optional Instruments – Instrument Tray

Article No.	Component	Basic	Optional
FG321R	Tightening key		1
FG322R	Fast tightening key		1
FW246R	Instrument tray (without Instruments)	1	





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Brochure No. 0323702