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## SAVANNAH® SPINAL SYSTEM IMPLANTS AND INSTRUMENTATION

This package insert covers the Savannah® Spinal System and Manual Surgical Instruments that are used for the implantation of this system. Specific sections for implants and instrumentation highlight important user information for only those devices.

### GENERAL INFORMATION

#### *Implants*

Spinal Elements' Savannah® Spinal System is comprised of a variety of pedicle screws, mono-axial and poly-axial screw heads, connecting rods, set screws, and transverse crossmembers, called the Savannah-Link. System components are available in a multitude of sizes and configurations. A variety of constructs may be assembled to suit the individual pathology and anatomy of the patient. All implant components are made from titanium alloy (Ti-6Al-4V) conforming to ASTM F 136 or ASTM F1472 and are provided non-sterile for single-use.

Spinal Elements' instruments are manufactured from various stainless steels, titanium, aluminums, and polymers. All materials used have a history of use in such instruments. All implants are intended for single patient use only and should not be reused (used in additional patients) under any circumstances. Reuse may result in serious injury or death. Components from this system should not be used in conjunction with components from other systems.

Navigated instruments are manual surgical instruments manufactured from stainless steel, as specified in ASTM F899 or ASTM A564. Navigated instruments are non-sterile and are intended to be used with the Medtronic StealthStation® System.

### INDICATIONS

The Savannah® is intended to provide immobilization and stabilization of spinal segments as an adjunct to fusion in the treatment of the following acute and chronic instabilities or deformities of the thoracic, lumbar, and/or sacral spine, specifically as follows: When intended for pedicle screw fixation of the non-cervical posterior spine in skeletally mature patients the Savannah® is indicated for one or more of the following: degenerative disc disease (defined as discogenic back pain with degeneration of the disc confirmed by history and radiographic studies); spondylolisthesis; fracture; dislocation; scoliosis; kyphosis; spinal tumor; and/or failed previous fusion (pseudarthrosis). In addition, when used as a pedicle screw fixation system, the Savannah® is indicated for skeletally mature patients having degenerative spondylolisthesis with objective evidence of neurologic impairment and/or severe spondylolisthesis (grades 3 and 4) of the fifth lumbar-first sacral (L5-S1) vertebral joint; who are receiving fusions using autogenous bone graft only; who are having the device fixed or attached to the lumbar and sacral spine (L3 and below); and who are having the device removed after the development of a solid fusion mass.

Spinal Elements Navigated Instruments are intended to be used during the preparation and placement of Spinal Elements Savannah® screws during spinal surgery to assist the surgeon in precisely locating anatomical structures in either open or minimally invasive procedures. These instruments are designed for use with the Medtronic StealthStation® System, which is indicated for any medical condition in which the use of stereotactic surgery may be appropriate, and where reference to a rigid anatomical structure, such as vertebra, can be identified relative to a CT or MR based model, fluoroscopy images, or digitized landmarks of the anatomy.

### CONTRAINDICATIONS

1. Any abnormality present which affects the normal process of bone remodeling including, but not limited to, severe osteoporosis involving the spine, active infection at the site or certain metabolic disorders affecting osteogenesis.
2. Insufficient quality or quantity of bone which would inhibit rigid device fixation.
3. Previous history of infection.
4. Excessive local inflammation.
5. Open wounds.
6. Any neuromuscular deficit which places an unusually heavy load on the device during the healing period.
7. 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.
8. Patients having inadequate tissue coverage of the operative site.

9. Pregnancy.
10. 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.
11. Foreign body sensitivity. Where material sensitivity is suspected, appropriate tests should be made prior to material selection or implantation.
12. Other medical or surgical condition 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.
13. Any contraindications to the compatible Medtronic StealthStation System are applicable to the Savannah® System.

## **WARNINGS**

Implants and instruments are provided non-sterile. Instruments must be cleaned and sterilized before use. Implants may be reprocessed prior to use and must be sterilized before use. Validated sterilization cycle parameter protocols are noted in the STERILIZATION section of this insert. Implants that have come in direct contact with a patient or bio-contaminants should be disposed of.

Some instruments may be sharp, depending on their intended use. Care should be taken in handling such instruments to avoid injury to the user or patient.

The safety and effectiveness of pedicle screw systems have been established only for spinal conditions with significant mechanical instability or deformity requiring fusion with instrumentation. These conditions are significant mechanical instability or deformity of the thoracic, lumbar, and sacral spine secondary to severe spondylolisthesis (grade 3 and 4) of the L5-S1 vertebra, degenerative spondylolisthesis with objective evidence of neurological impairment, fracture, dislocations, scoliosis, kyphosis, spinal tumor, and failed previous fusion (pseudoarthrosis). The safety and effectiveness of these devices for any other conditions are unknown.

A successful result is not always achieved in every surgical case. This fact is especially true in spinal surgery where many extenuating circumstances may compromise the results. System components are temporary implants used for the correction and stabilization of the spine. Devices are intended to be used to augment the development of a spinal fusion by providing temporary stabilization. Devices are not intended to be the sole means of spinal support. Use of these products without a bone graft or in cases that develop into a non-union will not be successful. No spinal implant can withstand body loads without the support of bone. In this event, bending, loosening, disassembly and/or breakage of the device(s) will occur.

Precaution: Implantation of pedicle screw spinal systems should be performed only by experienced surgeons with training in the use of spinal devices. This is a technically demanding procedure presenting a risk of serious injury to the patient.

Preoperative and operating procedures including knowledge of surgical techniques, proper reduction, and proper selection and placement of the implant are important considerations in the successful utilization of this device by the surgeon. Further, the proper selection and compliance of the patient will greatly affect the results. The physician should consider the levels of implantation, patient weight, patient activity level, and all other patient conditions that may have an impact on the performance of this device. Patients who smoke have been shown to have an increased incidence of non-union. These patients should be advised of this fact and warned of this consequence. Obese, malnourished, and/or alcohol abuse patients are also poor candidates for spine fusion. Patients with poor muscle and bone quality and/or nerve paralysis are also poor candidates for spine fusion.

Physician Note: The physician is the learned intermediary between the company and the patient. The indications, contraindications, warnings, and precautions given in this document must be conveyed to the patient.

1. Spinal Elements Navigated Instruments are validated for use with the StealthStation S7 system and software version v2.1.0. Do not attempt to use Spinal Elements Navigated Instruments with other models and software versions.
2. Spinal Elements is not a navigation software and system provider.
3. Examine all instruments for damage and deterioration prior to use. Do not use any instruments that are damaged.
4. All instruments must be successfully verified and registered prior to use. Do not use instruments that have not been successfully verified and registered with navigation.
5. Navigation accuracy should be frequently assessed during the procedure. Place the tip of the instrument on an identifiable anatomical landmark and compare it to the location displayed on the screen. Discontinue use immediately if inaccuracy is suspected.
6. Care should be taken to limit bending forces on instruments during navigation as deflection can adversely affect navigation accuracy, cause serious injury to the patient, and damage the instruments. Discontinue use immediately if the instrument becomes damaged during the procedure.
7. Spinal Elements instruments should only be used with Spinal Elements implants. Do not attempt to use with other competitive devices.

8. Refer to the Synergy Spine & Trauma Packet Guide for additional information regarding navigation.
9. Screw systems other than those indicated, should not be used with Medtronic StealthStation System.

### **MAGNETIC RESONANCE ENVIRONMENT**

The Savannah® Spinal System has not been evaluated for safety and compatibility in the MR environment. It has not been tested for heating, migration, or image artifact in the MR environment. The safety of the device in the MR environment is unknown. Scanning a patient who has this device may result in patient injury.

### **POSSIBLE ADVERSE EVENTS**

1. Early or late loosening of any or all of the components.
2. Disassembly, bending, and/or breakage of any or all of the components.
3. Loss of fixation (implant migration).
4. Foreign body (allergic) reaction to implants, debris, corrosion products (from crevice, fretting, and/or general corrosion), including metallosis, tissue reaction from the implant, staining, tumor formation, and/or autoimmune disease.
5. 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.
6. Pain, discomfort, or abnormal sensations due to the presence of the device
7. Pressure on the skin from components where inadequate tissue coverage exists over the implant, with the potential extrusion through the skin, seroma or wound dehiscence
8. Post-operative change in spinal curvature, loss of correction, height, and/or reduction.
9. Infection.
10. Dural tears, persistent CSF leakage, fistula requiring surgical repair, meningitis.
11. Loss of neurological function including paralysis (partial or complete), neurovascular compromise, radiculopathy, and/or the development or continuation of pain, paresthesia, numbness, foot-drop, spasms, or sensory loss.
12. Cauda equina syndrome, neurological deficits, paraplegia, reflex deficits, irritation, and/or muscle loss.
13. Loss of bladder control or other types of urological system compromise, gastrointestinal disorders.
14. Scar formation possibly causing neurological compromise or compression around nerves and/or pain.
15. Fracture, micro-fracture, resorption, damage, or penetration of any spinal bone.
16. Soft tissue injury, vascular, or visceral injury.
17. Herniated nucleus pulposus, disc disruption or degeneration at, above, or below the level of surgery.
18. Non-union (pseudo-arthrosis), delayed union, mal-union.
19. Cessation of any potential growth of the operated portion of the spine.
20. Loss of or increase in spinal mobility or function.
21. Intraoperative fissure, fracture, or perforation of the spine can occur due to implantation of the components. Postoperative fracture of the 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
22. Bone loss or decrease in bone density, possibly caused by stress shielding.
23. Hemorrhage, myocardial infarction, hematoma, occlusion, seroma, edema, hypertension, embolism, stroke, excessive bleeding, phlebitis, thrombus, wound necrosis, wound dehiscence, damage to blood vessels, or other types of cardiovascular system compromise.
24. Reproductive system compromise, including sterility, loss of consortium, and sexual dysfunction.
25. Inability to perform the activities of daily living.
26. Development of respiratory problems, e.g. pulmonary embolism, atelectasis, bronchitis, pneumonia, etc.
27. Change in mental status.
28. Heterotopic bone formation.
29. Graft site pain, fracture or wound healing problems
30. Death.

Additional surgery may be necessary to correct the occurrence of some of these possible adverse events.

### **PREOPERATIVE MANAGEMENT**

1. Verify that the StealthStation model and software version is correct. Spinal Elements Navigated Instruments are validated for use with the StealthStation S7 and software version v2.1.0.
2. The surgeon should consider for surgery only those patients indicated for the use of this device.
3. The surgeon should not consider for surgery those patients contraindicated for the use of this device.
4. The surgeon should have a complete understanding of the device's indications, contraindications, and applications.
5. The surgeon should have a complete understanding of the function and limitations of each implant and instrument.
6. Device components should be received and accepted only in packages that have not been damaged or tampered with. Components must be carefully handled and stored in a manner that prevents scratches, damage, and corrosion.

7. All implants and instrument should be inspected for wear and tear prior to use. Devices presenting damage such as cracks, corrosion, bends etc. should not be used. Compromised devices should be segregated and be returned to Spinal Elements.
8. The type of implant to be used for the case should be determined prior to beginning the surgery.
9. All instruments and implants should be processed and sterilized prior to use.

#### **INTRAOPERATIVE MANAGEMENT**

1. Caution should be taken in handling the implants. Damage to the implants may affect their performance.
2. Extreme caution should be used around the spinal cord and nerve roots. Damage to the nerves will cause loss of neurological functions.
3. Breakage, slippage, or misuse of instruments or implant components may cause injury to the patient or operative personnel.
4. Care should be taken during intraoperative forming of the rods. Sharp bends or notches in the rods may decrease their functional strength. Rods should not be repeatedly or excessively bent. Rods should never be reverse bent in the same location. If the rods are cut to length, they should be cut in such a way as to create a flat, non-sharp surface perpendicular to the midline of the rod. If the rods are cut, cut them outside of the operative field. Whenever possible, it is recommended to use precut rods.
5. Whenever possible or necessary, an imaging system should be utilized to facilitate surgery.
6. When the polyaxial head is at the limit of its angulation, care should be taken to ensure the head can properly accommodate the rod. The head should be perpendicular to the rod upon final-tightening.
7. Care should be taken when tapping or inserting screws. Proper size selection is critical. Incorrectly sized taps or screws may cause nerve damage, hemorrhage, or other possible adverse events listed in this package insert.
8. Always use supplied gauges to verify the sizes of screws to be implanted prior to implantation. Do not rely solely on markings or color coding on the implants.
9. Caution should be taken not to over-tighten implants, instruments, and interfaces between implants and instruments.
10. Before closing the soft tissue, all screws or locking/securing mechanisms should be tightened. Recheck the tightness of all components after finishing to ensure that none loosened during the tightening of other components.
11. Implants should not be reused under any circumstances.

#### **POSTOPERATIVE MANAGEMENT**

Postoperative management by the surgeon, including instruction and warning to and compliance by the patient, of the following is essential:

1. The patient should have a complete understanding of and compliance with the purpose and limitations of implant devices.
2. Postoperative patients should be instructed to limit activity as determined by their surgeon. If partial weight bearing is recommended or required prior to firm bony union, the patient must be warned that bending, loosening, and/or breakage of the device(s) are complications which may occur as a result of excessive or early weight bearing or muscular activity. The risk of bending, loosening, or breakage of a temporary internal fixation device during postoperative rehabilitation may be increased if the patient is active, or if the patient is debilitated or demented. The patient should be warned to avoid falls or sudden jolts in the spinal position.
3. To allow the maximum chances for a successful surgical result, the patient or devices should not be exposed to mechanical vibrations or shock that may loosen the device construct. The patient should be warned of this possibility and instructed to limit and restrict physical activities, especially lifting and twisting motions and any type of sport participation. The patient should be advised not to smoke tobacco or utilize nicotine products, or to consume alcohol or non-steroidal or anti-inflammatory medications such as aspirin during the bone graft healing process.
4. The patient should be advised of their inability to bend or rotate at the point of spinal fusion and taught to compensate for this permanent physical restriction in body motion.
5. Failure to immobilize a delayed or non-union of bone will result in excessive and repeated stresses on the implant. By the mechanism of fatigue, these stresses can cause the eventual bending, loosening, or breakage of the device(s). It is important that immobilization of the spinal surgical site be maintained until firm bony union is established and confirmed by roentgenographic examination. If a state of non-union persists or if the components loosen, bend, and/or break, the device(s) should be revised and/or removed immediately before serious injury occurs. The patient must be adequately warned of these hazards and closely supervised to ensure cooperation until bony union is confirmed.
6. The implants are temporary internal fixation devices. Internal fixation devices are designed to stabilize the operative site during the normal healing process. After the spine is fused, these devices serve no functional purpose and may be removed. While the final decision on implant removal is up to the surgeon and patient, in most patients, removal is indicated because the implants are not intended to transfer or support forces developed during normal activities. If the device is not removed following completion of its intended use, one or more of the following complications may occur: (1) corrosion, with localized tissue reaction or pain; (2) migration of implant position, possibly resulting in injury; (3) risk of additional injury from postoperative trauma; (4) bending, loosening and breakage, which could make removal impractical or difficult; (5) pain, discomfort, or abnormal sensations due to the presence of the device; (6) possible increased risk of infection; (7) bone loss due to stress shielding; and (8) potential unknown and/or unexpected long term effects such as carcinogenesis.

Implant removal should be followed by adequate postoperative management to avoid fracture, re-fracture, or other complications.

7. Retrieved implants should be properly disposed of and are not to be reused under any circumstance.

### **SINGLE USE**

Reuse of a single use device that has come in contact with blood, bone, tissue or other body fluids may lead to patient or user injury. Possible risks associated with reuse of a single use device include, but are not limited to, mechanical failure, serious injury, transmission of infectious agents and death.

Implants that have directly come in contact with the patient or bio-contaminants should be discarded. Separate inserts for implants from the instrument tray prior to and during any processing.

## **CLEANING AND MAINTENANCE**

All devices must be free of packaging material prior to reprocessing. All instruments must be free of bio-contaminants prior to reprocessing. Cleaning, maintenance and mechanical inspection must be performed by hospital personnel trained in the general procedures involving contaminant removal. Only neutral pH cleaners or detergents labeled for use in cleaning medical devices should be used for cleaning components. Only lubricants that are intended for use on surgical instruments should be used to lubricate instruments. Follow directions from the manufacturer of lubricating and cleaning agents regarding handling, concentration, and use of such agents.

Cleaning instructions are provided in accordance with recognized standards and regulations and are intended to supplement a hospital's existing device cleaning and disinfecting protocol. Contaminated devices should be wiped clean of visible soil at the point of use prior to transfer to a central processing unit for cleaning and sterilization. Contaminated devices must be cleaned promptly after use per the instructions provided in this insert to minimize drying and ensure an effective cleaning.

Use clean flowing water and disposable wipes to remove excess soil. Reprocess instruments as soon as possible to prevent body fluid and tissue from drying on instruments prior to cleaning.

Disassemble all components to provide maximum exposure for cleaning.

All devices must be processed manually prior to automated cleaning.

Cleaning agents with chlorine or chloride as an active ingredient are corrosive to stainless steel and should not be used.

Saline solution has a corrosive effect on stainless steel and should not be used. Use only neutral pH cleaning agents and detergents.

Caution: Automated washer/disinfector systems are not recommended as the sole cleaning method for surgical instruments. Automated cleaning may not be effective. A thorough, manual cleaning process is recommended. An automated system may be used as a follow-up method to manual cleaning.

### **AUTOMATED CLEANING INSTRUCTIONS**

All devices must be processed manually prior to automated cleaning. Follow the instructions below for the manual and automated washing.

#### **PRE-AUTOMATED WASHER: MANUAL CLEANING**

1. Immerse and soak for a minimum of five (5) minutes in enzymatic detergent at <43°C.
2. Immerse in Endozime® AW Plus enzymatic detergent (or equivalent neutral pH enzymatic cleaner) according to manufacturer recommendations and clean thoroughly for at least 14 minutes at <43°C. Scrub all external surfaces with a soft bristle brush until all visible soil has been removed. It is important to make sure that areas of concern with complex or hidden surfaces are effectively cleaned. Use a small diameter brush to clean cannulation holes. Inspect for visible soil on exposed surfaces.
3. Rinse thoroughly for 2 minutes with warm demineralized water. (Purified water at 27°-44°C)

#### **AUTOMATED CLEANING**

4. Transfer the instruments into the automated washer for processing. Position the instruments to allow for proper drainage. Ensure the instruments stay in place and do not touch or overlap so that the design features are accessible for cleaning and do not retain liquid. Process per the cycle below. These are minimum validated parameters:

<b>Phase</b>	<b>Recirculation Time</b>	<b>Water Temp</b>	<b>Detergent Type (if applicable)</b>
Pre-wash	300 seconds	Cold tap water	N/A
Wash 1	300 seconds	65.5°C	Endozime AW Plus or equivalent per manufacturer's instructions

Wash 2	300 seconds	65.5°C	Endozime AW Plus or equivalent per manufacturer's instructions
PURW Rinse	10 seconds	82.2°C	N/A
Drying	7 minutes	115.5°C	N/A

5. If needed, dry devices using a clean lint-free cloth. Pressurized air (20psi) may be used to assist in drying.
6. Visually examine devices to ensure all visible soil has been removed.
7. Once instruments pass visual inspection, reassemble devices that come apart for cleaning.

### MANUAL CLEANING INSTRUCTIONS

Follow the instructions listed below for manual cleaning prior to sterilization.

1. Immerse and soak for a minimum of five (5) minutes in enzymatic detergent at <43°C.
2. Immerse in Endozime® AW Plus enzymatic detergent (or equivalent neutral pH enzymatic cleaner) according to manufacturer recommendations and clean thoroughly for at least 14 minutes at <43°C. Scrub all external surfaces with a soft bristle brush until all visible soil has been removed. It is important to make sure that areas of concern with complex or hidden surfaces are effectively cleaned. Use a small diameter brush to clean cannulation holes. Inspect for visible soil on exposed surfaces.
3. Rinse thoroughly for 2 minutes with warm distilled, deionized, or reverse osmosis water. (at 27°-44°C)
4. Allow instrument to air dry in a clean area. Blow lumens with clean air using filtered air source or syringe.

Carefully inspect each device to ensure that all visible blood and soil have been removed. Inspect lumens to confirm that all foreign material has been removed. Visually inspect for damage and/or wear.

Note: If any damage or wear is noted that impairs the function of the instrument, contact your Spinal Elements representative for a replacement.

### STERILIZATION

Implants and instruments are provided non-sterile and must be sterilized before use. Non-sterile implants and instruments should be autoclave sterilized using one of the following validated cycle parameters.

	Method	Cycle Type	Sterilization Temperature	Exposure Time	Dry Time
Wrapped	Steam	Pre-vacuum	270°F (132°C)	10 minutes	60 minutes
Rigid Container	Steam	Pre-vacuum	270°F (132°C)	4 minutes	30 minutes
K-Wire Caddy	Steam	Pre-vacuum	270°F (132°C)	4 minutes	20 minutes

Sterilization parameters were validated per *ANSI/AAMI/ISO 17665-1: 2006. Sterilization of Health Care Products – Moist Heat – Part 1 Requirements for the Development, Validation, and Routine Control of a Sterilization Process for Medical Devices* and *ANSI-AAMI ST79 - Comprehensive guide to steam sterilization and sterility assurance in health care facilities*. These parameters were validated to a sterility assurance level (SAL) of 10<sup>-6</sup>. These sterilization cycles are not

considered by the Food and Drug Administration to be standard sterilization cycles. It is the end user's responsibility to use only sterilizers and accessories (such as sterilization wraps, sterilization pouches, chemical indicators, biological indicators, and sterilization cassettes) that have been cleared by the Food and Drug Administration for the selected sterilization cycle specifications (time and temperature).

## INFORMATION



Catalog Number



Material



Batch Code



Packaged Quantity



Manufacturer



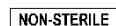
Date of Manufacture



Caution, Consult  
Accompanying  
Documents



Do Not Re-Use



Device Not Sterile



Prescription Only



Instruction for Use are provided electronically at [ifu.spinalelements.com](http://ifu.spinalelements.com)

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Patent: [patent.spinalelements.com](http://patent.spinalelements.com)

For additional information regarding any of Spinal Elements' devices, please contact Spinal Elements, Inc. Customer Service at (760) 607-0121.

**CAUTION: Federal Law (USA) restricts these devices to sale by or on the order of a physician.**