SUMMARY OF SAFETY AND CLINICAL PERFORMANCE intended for users/health care professionals

LISA – Lumbar Implant for Stiffness Augmentation

BACKBONE

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Le Bouscat

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France

Contents

List of Acronyms

AFAP: as far as possible

ALIF: anterior lumbar inter-body fusion

CER: clinical evaluation report

CS: Common specifications

EU: European Union

Eudamed: European database on medical devices

FSCA: Field Safety Corrective Action

FSN: Field Safety Notice

IFU: Instructions for Use

MDCG: Medical Device Coordination Group

MDR: Medical Device Regulation

N/A: not applicable

NB: Notified Body

PEEK: PolyEtherEtherKetone

PMCF: post market follow-up

PMS: post market surveillance

RM: risk management

S&P: safety and performance

SRN: Single Registration Number

SSCP: Summary of Safety and Clinical Performance

SSI: Secondary Surgical Intervention

UDI-DI: Unique Device Identification – device identifier

This Summary of Safety and Clinical Performance (SSCP) is intended to provide public access to an updated summary of the main aspects of the safety and clinical performance of the LISA (Lumbar Implant for Stiffness Augmentation). The SSCP is not intended to replace the Instructions For Use as the main document to ensure the safe use of the device, nor is it intended to provide diagnostic or therapeutic suggestions to intended users or patients.

The following information is intended for users/healthcare professionals. This information has been prepared in accordance with the Medical Device Coordination Group (MDCG)[1] 2019-9 Rev. 1,[2] "Summary of safety and clinical performance. A guide for manufacturers and notified bodies" to meet the requirements of Article 32 of the Medical Devices Regulation (EU) 2017/745 (MDR).[3]

The document will be translated into languages of the Member States where LISA is envisaged to be sold. There will be one SSCP for each language, according to the MDCG 2019-9 Rev.1[2].

Following this information, there is a summary intended for patients.

1. Device identification and general information

1.1 Device trade name(s)

The device trade name is Lumbar Implant for Stiffness Augmentation, i.e. LISA.

[1] MDCG is provides advice to the European Commission and assists the European Commission and Member States in ensuring a harmonised implementation of medical devices Regulations (EU) 2017/745 and 2017/746.
[2] https://ec.europa.eu/health/system/files/2022-03/md_mdcg_2019_9_sscp_en.pdf
[3] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0745

1.2 Manufacturer's name and adress

Manufacturer Name	Backbone
Manufacturer Address	81 Boulevard Pierre 1er Le Bouscat 33110 France

1.3 Manufacturer's SRN (single registration number)

The SRN of the company is **: FR-MF-000001874**

1.4 Basic UDI-DI

Table 1.4-1 : Basic-UDI-DI for LISA implants

Product Code	Device Name	Basic UDI-DI
LISA Implants		
BB-LISA-1-101	Band	376024863LISA101FT
BB-LISA-1-104	Blocker	376024863LISA104FZ
BB-LISA-1-106	Spacer Size 6	376024863LISA106G5
BB-LISA-1-108	Spacer Size 8	376024863LISA106G5
BB-LISA-1-110	Spacer Size 10	376024863LISA106G5
BB-LISA-1-112	Spacer Size 12	376024863LISA106G5

1.5 Medical device nomenclature

Table 1.5-1 : Medical device nomenclature for LISA implants

Product Code	Device Name	EMDN Code	Description
LISA Implants			
BB-LISA-1-101	Band	P09070305	SPINAL STABILIZERS DINAMIC TYPE
BB-LISA-1-104	Blocker	P09070305	SPINAL STABILIZERS DINAMIC TYPE
BB-LISA-1-106	Spacer Size 6	P09070305	SPINAL STABILIZERS DINAMIC TYPE
BB-LISA-1-108	Spacer Size 8	P09070305	SPINAL STABILIZERS DINAMIC TYPE

Product Code	Device Name	EMDN Code	Description
BB-LISA-1-110	Spacer Size 10	P09070305	SPINAL STABILIZERS DINAMIC TYPE
BB-LISA-1-112	Spacer Size 12	P09070305	SPINAL STABILIZERS DINAMIC TYPE

1.6 Class of device

The classification of LISA implants under the Medical Device Regulation is provided in the Table below.

Table 1.6-1 : Device classification (MDR) for LISA implants

Product Code	Device Name	Class	Rule
LISA Implants			
BB-LISA-1-101	Band	Class III	Rule 8
BB-LISA-1-104	Blocker	Class III	Rule 8
BB-LISA-1-106	Spacer Size 6	Class III	Rule 8
BB-LISA-1-108	Spacer Size 8	Class III	Rule 8
BB-LISA-1-110	Spacer Size 10	Class III	Rule 8
BB-LISA-1-112	Spacer Size 12	Class III	Rule 8

1.7 Year when the first certificate (CE) was issued covering the device

LISA Implants obtained their CE marking under the Medical Device Directive 93/42/EEC in 2018 (October). It was valid until October 18th, 2023.

LISA Implants have obtained a valid CE certificate under the Medical Device Regulation (MDR) 2017/745 since February 2024 for a validity period of 5 years.

Certificate number : MDR 766576

1.8 Authorized representative if applicable; name and the SRN

Not applicable as BACKBONE is located in the European Union.

1.9 NB (Notified Body)'s name and NB's single identification number

Table 1.9-1 : Backbone NB's name for LISA implants and NB's single identification number

Notified Body Name	BSI Group The Netherlands B.V.
Single Identification Number	CE 2797

2. Intended use of the device

2.1 Intended purpose

The intended purpose of the LISA device is to safely improve back pain, leg pain and disability while allowing motion preservation between two adjacent lumbar vertebrae when used in degenerative lesions of grade II, III, IV according to Pfirmann MRI classification. It can be used in up to two adjacent levels from L1 to L5.

2.1.1 Intended users

Please refer to section 2.2

2.1.2 Intended target populations

Please refer to section 2.2.

2.1.3 Indications

Please refer to section 2.2.

2.1.4 Contraindications

Please refer to section 2.3.

2.1.5 Warnings

Please refer to section 4.2.1

2.1.6 Precautions

Please refer to section 4.2.2

2.1.7 Adverse effects

Please refer to section 4.1.2

2.1.8 Residual risks

Please refer to section 4.2.2

2.2 Inteded users and intended target population(s) and indications

- **Inteded users**

LISA devices must be implanted by surgeons who have been properly trained in spinal surgery. The decision to implant them should be made only after taking into consideration the medical and surgical indications, contraindications, side effects and precautions contained in the Instructions For Use and the limitations of this type of surgery.

- **Intended target populations**

LISA is intended to be used on skeletally mature patients suffering from low-back pain that accompanies degenerative lesions of grade II, III and IV (Pfirrmann MRI classification), in accordance with the indications and contra-indications of the device.

- **Indications**

The LISA Posterior Dynamic Stabilization System treats low-back pain that accompanies degenerative lesions of grade II, III and IV (Pfirrmann MRI classification).

2.3 Contraindications

Contraindications:

a. Stage V degenerative disk lesions in Pfirrmann's MRI classification.
b. Spondylolisthesis.
c. Osteoporosis.
d. Non-specific back pain.
e. Modic 2 and Modic 3 changes.
f. This device is not indicated for the L5/S1 segments.
g. Local or general infections that may compromise the surgical goals.
h. Major local inflammatory phenomena.
i. Pregnancy.
j. Immunosuppressive diseases.
k. Bone immaturity.
l. Severe mental illnesses.
m. Bone metabolism diseases that may compromise the mechanical support expected from this type of implant.
n. Excessive physical activities.

3. Device description

3.1 Description of the device

LISA device is a posterior lumbar dynamic stabilization system designed to stabilize the treated level while preserving motion.

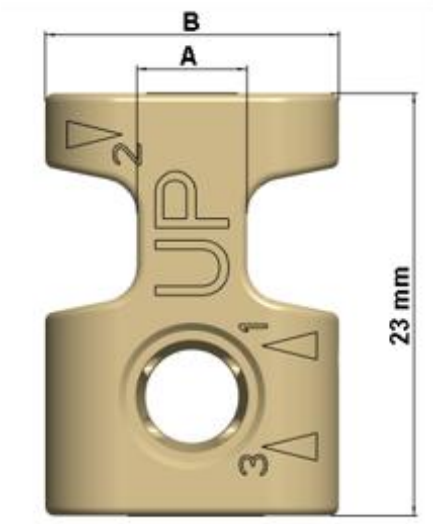
The LISA device consists of 3 components : A PolyEtherEtherKetone (PEEK) interspinous spacer, a polyester band and a titanium blocker. The spacer is positioned between two adjacent spinous processes, the band is belted around the spinous processes and through the spacer, and the blocker is used to lock the band inside the spacer.

The LISA implant is a single use device and the reuse of LISA may cause infections or ineffective cares. These devices must be implanted by surgeons who have been properly trained in spinal surgery. The decision to implant them should be made only after taking into consideration the medical and surgical indications, contraindications, side effects and precautions contained in these Instructions For Use and the limitations of this type of surgery.

The LISA three main components are further described hereafter:

- Spacer

  The Spacer is made of PEEK. The device is single use, supplied in a sterile packaging gamma irradiated. Four sizes of spacers are available: 6, 8, 10 and 12 (the following image gives details about the different sizes). The spacer will be in contact with spinous process, blood and soft tissue.



Overall dimensions:

- *Height = 14mm*
- *Length = 23mm*
- *Size 6 A = 6mm B = 16mm*
- *Size 8 A = 8mm B = 18mm*
- *Size 10 A = 10mm B = 20mm*
- *Size 12 A = 12mm B = 22mm*

Figure 3.1 – 1 : Image and overall dimensions of LISA spacer which is available in four different sizes

- Band

  The Band is a woven braid made of polyester. The device is single use, supplied in a sterile packaging gamma irradiated. The device is a flat band (700 mm long and 7,2 mm wide) with a 50 mm distal extremity rigidified by heat treatment. The proximal extremity pertains to a sown mound. The band will be in contact with spinous process, blood and soft tissue.

- Blocker

  The blocker is made of Titanium Alloy. The device is single use, supplied in a sterile packaging gamma irradiated. The device has a Torx imprint, conical shape at the bottom. The blocker will be in contact with blood and soft tissue.

3.2 A reference to previous generation(s) or variants if such exist, and a description of the differences

There are no previous generation(s) or variants for LISA implants.

3.3 Description of any accessories which are intended to be used in combination with the device

The LISA Implants are not intended to be used with any accessories.

3.4 Description of any other devices and products which are intended to be used in combination with the device

The implants are used in conjunction with the surgical instruments that permit its implantation.

LISA is composed of:

- Reusable invasive instruments supplied non-sterile but intended to be sterilized by healthcare facility before use including: trial spacers, band forceps (I or II), hooks (hook wide or hook), interlaminar distractor (optional) and implant holders. They are intended to contact the patient (i.e. bone, blood and/or soft tissue) during a short period of time (less than 1 hour) during the surgery.
- Reusable non-invasive instruments supplied non-sterile but intended to be sterilized by the healthcare facility before use including: locker, tensioner, torque limiting handle, torque limiting connector, gripper screwdriver, additional wrench and tray. They are not intended to contact the patient during the surgery.

Table 3.4-1 : Description of reusable invasive instruments used for the placement of LISA device.

Device Name	Description
Trial spacer	The device is intended to retract the nose or the superior part of the spinous process to access the interspinous space. The surgeon introduces the trial spacer, starting with the smallest size (6), to appreciate the appropriate size of the spacer (6, 8, 10 or 12).
Band Forceps I	Once the band has been pierced through the interspinous ligament with the hook, the band is clamped and gripped by the band forceps and pulled through the interspinous ligament.
Band Forceps II	
Hook wide	The device is intended to cut through the interspinous ligaments and accompany the band through the interspinous ligaments.
Hook	

Interlaminar distractor	This instrument may be used to retract the laminas before inserting the spacer between the spinous processes.
Implant Holder	The device is intended to clamp the spacer with its lateral claws and keep the spacer stable laterally during the procedure.

Table 3.4-2 : Description of reusable non-invasive instruments used for the placement of LISA device.

Device Name	Description
Locker	The device is intended to be screwed to the spacer through the implant holder and keep the spacer stable vertically during the procedure.
Tensioner	Prior to the LISA braid tensioning step, the tensioner is connected to the implant holder. It is slipped onto the external diameter of the proximal part of the implant holder and is maintained at a height of approximately 8 cm from the patient's skin by resting vertically on the shoulder of the implant holder. It should be noted that the tensioner remains mobile in rotation around the vertical axis of the implant holder in order to be positioned optimally to maximize the tension. The distal end of the braid is inserted between the flat and the pin of the tensioning wheel. The braid is then tensioned by turning the tensioning wheel clockwise.
Torque Limiting Handle	The torque limiting handle is connected to the tensioner via the connector and tension can be provided by the T handle until the torque limit. The torque limiting handle is connected to the Gripper Screwdriver without connector to lock the LISA Blocker in the LISA Spacer
Torque Limiting Connector	The device connects the Torque limiting handle to the tensioner.
Gripper Screwdriver	The gripper screwdriver grips the LISA blocker (its self-retaining extremity holds the blocker and avoids loosening) and introduced through the implant holder in order to screw the LISA blocker into the LISA spacer and lock the system.
Additional Wrench	Optionnal instrument which can be connected with the tensioner wheel into the same hexagonal imprint used by the Torque Limiting Handle with its

	connector. This instrument allows a more comfortable action to increase and to control the tension of the LISA band by the operator.
Instruments Tray	It is intended to provide storage for instruments.

4. Risks and warnings

4.1 Residual risks and adverse effects

4.1.1 Adverse effects

All potential adverse effects of spinal surgery independent of the medical device are possible. The adverse effects include, among others:

- Neurological complications, paralysis, soft tissue injuries, pain,
- Superficial or deep infections and inflammatory phenomena
- Spinous Process Fractures
- Herniated disc/Recurrence of herniated disc
- Residual stenosis
- Neurological injuries and/or damages to the dura mater during the surgical procedure
- Alteration of the bone density due to a change in the distribution of mechanical stresses

With the use of implants from the LISA dynamic stabilization system, the list of potential adverse effect may include:

- Device migration, dislodgment, implant loosening or breakage.
- Spinous Process Fractures
- Allergic reactions to the materials comprising the implant.
- Heating or migration of the implant following the use of magnetic resonance imaging
- Neurological complications following the device use
- Paralysis following the device use following the device use
- Though the pain is reduced, the pain is not sufficiently contained following LISA implantation
- Superficial or deep infections following the device use
- Inflammatory phenomena following the device use
- Alteration of the bone density due to a change in the distribution of mechanical stresses following the device use
- Duramater injury following the device use
- New stenosis after the use of LISA
- Adjacent level slip
- Modic changes in endplate due to the LISA implantation
- Recurrent disc herniation due to the LISA implantation

The Table below reports side-effects identified for LISA Implants during Backbone's PMS data review including MDR Art. 88 trending review, review of public databases, and literature search. For these side-effects, incidence reported in the literature for similar devices and other alternatives are described and then, acceptability of LISA side-effects vs. state of the art is discussed.

Expected Side-effects identified for LISA Implants	Available incidence in the LISA PMCF study	Available incidence for similar medical devices	Available incidence for other alternatives	Acceptability of LISA side-effects vs. State of the Art
Backbone's PMS data review including MDR Art. 88 trending review				
Side-effects possibly related to the device (and the procedure)				
Spinous Process Fractures	1/139 (0.7%)	Wallis 2nd generation: 0.5% (1) DIAM: Incidence of [0-5%] (2) [4]	Coflex: 3.3% (3) Superion (Vertiflex): Incidence of 11.1% at 2 years (4)	Yes – The incidence for LISA (0.7%) is within the range of incidences reported for similar devices [0-5%] and alternatives [3-11%]
Recurrence of herniated disc at the operated level	1/139 (0.7%)	Wallis 2nd generation: 2.5%-13.9% (5)	Decompression: 16.6% (5)	Yes – The incidence for LISA (0.7%) is within the range of incidences reported for similar devices [2-14%] and alternatives (around 16%)
Hematoma	1/139 (0.7%)	11%	Incidence not reported	Yes – The incidence for LISA (0.7%) is within the range of incidences reported for similar devices (11%)
Side-effects possibly related to the procedure				
Dural injury	7/139 (5.0%)	Incidence not reported	Incidence not reported	Yes – The incidence for LISA (5.0%) is low
Implant erosion, dislocation, breakage, loosening	0/139 (0.0%)	Wallis 2nd generation: 3.7% (loosening, breakage or migration) (6)	Posterior motion preservation lumbar devices: 11.7% (loosening) (7–9)	Yes – No occurrence for LISA was reported
Migration or rupture of any implant component	0/139 (0.0%)	Wallis 2nd generation: 3.7% (loosening, breakage or migration) (6)	Posterior motion preservation lumbar devices: 11.7% (loosening) (7–9)	Yes – No occurrence for LISA was reported
Degeneration of the adjacent segments	1/139 (0.7%)	Wallis 2nd generation: 1.5% (1)	Incidence not reported	Yes – The incidence for LISA (0.7%) is within the incidence reported for similar devices (1.5%)

Recurrence of initial symptoms	5/139 (3.6%)	Wallis 2nd generation: 2.5%-13.9% (5)	Decompression: 16.6% (5)	Yes – The incidence for LISA (3.6%) is lower than the incidence reported for similar devices (14%) and alternatives (17%)
Superficial or deep infection	3/139 (2.2%)	Wallis 2nd generation: 4% (deep infection), 4% (superficial wound infection) (1)	Decompression: 2.3% (superficial infection), 1.1% (deep infection) (10) Interspinous Process Devices: 0.9% (deep infection) (10) Pedicle screw- based dynamic stabilization system: 4.3% (surgical-site infection) (7–9)	Yes – The incidence for LISA (2.2%) is within the incidence reported for similar devices (4%) and alternatives (around 1-4%)
Bone fracture or bone erosion	3/139 (2.2%)	Wallis 2nd generation: 50% (bone resorption) (11)	Coflex: 47% (bone erosion) (6)	Yes – The incidence for LISA (2.2%) is lower than the incidence reported for similar devices (50%) and alternatives (47%)
Pain	2/139 (1.4%)	DIAM: 28.8% (back pain) at 2 years follow-up, 32.4% (leg pain) at 2 years (12)	Interspinous process devices: 33% for the period [0-60 months follow- up] (6) Fusion: 28.6% (13)	Yes – The incidence for LISA (1.4%) is lower than the incidence reported for similar devices [29-32%] and alternatives [29-33%]
Other*	14/139 (10.1%)	-	-	-
LISA removal**	11/139 (7.9%)	Wallis 1st generation: 18.3% (14) at 14 years Wallis 2nd generation: 8% (1) DIAM: 2.7% (12)	Incidence not reported	Yes – The incidence for LISA (7.9%) is within the range of incidence for similar devices [3%-18%]
Revision**	3/139 (2.2%)	Wallis 1st generation: 7.5% (15) at 40 months, 21.1% (16) at 14 years Wallis 2nd generation: 13% (1)	Incidence not reported	Yes – The incidence for LISA (2.2%) is lower than the range of incidence for similar devices [7%-21%]
Reoperation**	17/139 (12.2%)	DIAM: 4.7%-11% (12,17,18)	Incidence not reported	Yes – The incidence for LISA (12.2%) is slightly higher than

				the range of incidence for similar devices [5%-11%], but LISA is used in patients with poorest medical conditions
Review of public databases				
None	N/A	N/A	N/A	N/A
Literature search				
None (No article published on LISA at the moment)	N/A	N/A	N/A	N/A

[4] https://www.fda.gov/media/95915/download

**Bladder sphincter disorder, bleeding, delayed wound healing, disc herniation at the index level, disc herniation at another level, fall, fever, hematorachis, infection during procedure*

***SSI linked to a side-effect*

All the reported side-effects inherent to the use of LISA are already described in the literature either for alternatives or similar technologies.

The side-effects identified in this evaluation are acceptable in regard to the state of the art and in comparison to alternatives.

4.1.2 Residual risks

1. Torque Limiting Handle: The torque limiting handle is required to be used to limit the tightening of the band around the spinous processes. With an excessive tightening, there is a risk of spinous process fracture during the surgery of short term after the surgery. The limiting handle and the torque limitation have been defined based on the literature, and the device has been designed and produced to verify that the torque limiting handle achieves its performance. The handle is required to avoid the risk of spinous process fracture.

2. Leachable substance from the band inside the patient: The band raw materials have been selected to be compatible with patient safety. All tests complied with the acceptance criteria and met the expectations of the respective standards though a slight irritation was observed. Possible side effects may include allergic reactions to materials of the implant and inflammatory phenomenon.

4.2 Warnings and precautions

4.2.1 Warnings

The IFU provides the following warnings:

- The LISA implant is a single-use device, and the reuse of LISA may cause infections or ineffective care.
- Sterile implants must never be re-sterilized. Potential risks related to re-sterilization of the device that might affect the patient health and safety include:
    - The transmission of infectious or viral agents: no re-sterilization method has been validated for this device.
    - Change in the physical properties of the material composing the device leads to loss of functionality and mechanical properties, including rupture or degradation of the device.
- Even if a device seems intact after being removed from a patient, these implants should never be re-used. Potential risks related to the re-use of the device that might affect a patient's health and safety include:
    - The transmission of infectious or viral agents. The implant may not be re-cleaned or re-sterilized.
    - Loss of the functional and mechanical properties of the implant (including possible rupture) after the first implantation and subsequent removal of the device.
- Any contaminated implant should be treated as biological waste
- The implant may impede localized medical procedures such as lumbar punctures or spinal anesthesia.

The following warnings for the surgeon during the surgery are indicated in the surgical technique:

- The interspinous space should not be greater after implant insertion. Do not overdistract the interspinous space.
- During the insertion of the spacer, never force the implant into position by impaction. Use an interlaminar distractor, if necesssary.
- During the locking phase of the implant, the screwing must be stopped as soon the blocking sensation occurs. It is very important not to try to reach the torque limit as this may damage the implant.
- During the final step, the surgeon should cut the band in an upward direction to eliminate any risk of damaging the band.

4.2.2 Precautions

The IFU provides the following precautions:

- Pre-operative precautions

a. Patient's weight: overweight conditions cause additional stresses that may lead, in combination with other factors, to the rupture of the implants.
b. Mental handicap: there is a greater risk in patients who cannot follow the surgeon's recommendations.
c. Hypersensitivity to PEEK and/or PET and/or constituent metals: if hypersensitivity is suspected or confirmed, it is recommended that the patient's tolerance of the substances comprising the implant be checked before inserting the device.

- Per-operative precautions

  The details of the operative instructions are found in the LISA Surgical Technique supplied by BACKBONE.

  a. Insertion of an implant must be done using the instruments designed and supplied for this purpose and the specific technique for each device.
  b. Bone quality: a case of osteoporosis or any other tissue disease that may alter the spinous processes' mechanical properties must be considered when deciding to use a **LISA** implant.
  c. It is imperative that the level of tension given by the tensioner used simultaneously with the torque limiting handle be followed. If the user overtightens beyond the recommended tension, the resulting tension on the band may damage the spinous processes, depending on the patient's bone quality.

- Post-operative precautions

  The surgeon should warn the patient about the precautions to be taken after the implantation of the device. If the performance of the device changes from what the surgeon indicated, the patient must contact the surgeon.

  a. A rigid external lumbar support usually is not required. However, this decision is up to the surgeon, depending on each patient (bone quality, treated and related diseases, patient-level of activity and weight, etc…).
  b. Patient physical activity: intense physical activity increases the risk of mobility, deformation and rupture of the implants.
  c. A physical handicap will require special attention or adaptation to the post-operative rehabilitation method.
  d. After the implantation of LISA, the surgeon gives to the patient the implant card completed with the identification labels of the LISA implants used

4.3 Other relevant aspects of safety, including a summary of any field safety corrective action (FSCA including FSN) if applicable

The LISA Implant has not been subject to a Field Safety Corrective Action (FSCA) neither to a Field Safety Notice (FSN) since initial commercialization.

5. Summary of clinical evaluation and post-market clinical follow-up (PMCF)

5.1 Summary of clinical data related to equivalent device, if applicable

To date, Backbone has elected not to use the clinical data from an equivalent (clinical, technical and biological characteristics) device.

5.2 Summary of clinical data from conducted investigations of the device before the CE-marking, if applicable

BACKBONE did not conduct a clinical investigation for the LISA Implants before CE-marking.

5.3 Summary of clinical data from other sources, if applicable

5.3.1 Systematic literature review

Systematic literature review did not yield publications in which the LISA Implants were studied clinically.

5.3.2 Clinically relevant information based on clinical data obtained from implementation of the Manufacturer's PMCF and PMS plans

5.3.2.1. Customer complaints

Backbone sold 7,833 components of LISA Implants (including 2,280 bands, 2,578 blockers, and 2,975 spacers) pertaining to a maximum of 2,280 potential LISA surgeries from October 2018 to March 2025. During this period, 5 complaints were received and one was reported to authorities as precautionnary measure (the surgeon did not follow the labelling precautions and applied too large a force in positioning the blocker into the spacer). As a result, BACKBONE modified the surgical technique to reinforce the associated precautions). This corresponds to a complaint rate

of 0.22% received and a reportable event rate of 0% (the event has been reported as precautionnary measure). In addition, 3 adverse events possibly related to the device (2.16%) were reported in the context of the LISA PMCF study: one case of hematoma following the surgery, one case of recurrence of initial symptoms, and one spinous process fracture. All these adverse events were considered as expected undesirable effects.

Review of Backbone PMS from October 2018 to March 2025 did not identify any unknown clinical risks related to the use of LISA.

Internal records referring to non-serious incidents or expected undesirable side-effects demonstrated no statistically significant increases in frequency or severity for trend reporting. Backbone determined the frequency and severity trends were within acceptable threshold values as defined in the risk management activities in terms of probability and severity.

5.3.2.2. PMCF study

Backbone has initiated one PMCF study, which is ongoing.

As regards to the LISA PMCF study (NCT04631133) and its preliminary results :

- To date, 139/136 patients have been included. Pre-operative and per-operative data are available for 139 patients. Then, data at 3-months follow-up, 6-months follow-up, 12-months follow-up, 24-months follow-up and 48-months follow-up are available for 139, 132, 124, 106 and 44 patients, respectively. Collected data at 48-months of follow-up have not been sufficiently monitored to be exploited at present for performance and safety results.
- In terms of LISA PMCF study results, an interim analysis report at 12-months follow-up is available. Please note that other results are preliminary and not validated.
- In terms of performance/clinical benefits preliminary results, a decrease in ODI and VAS from pre-operation for back pain and leg pain was observed in the 106 patients who have reached the 2-year follow-up. The number of levels operated does not seem to impact these LISA performance results. Mobility at the different follow-up assessments and within a range acceptable as regards to the State of the Art (7–9) was also observed.
- As regards the perioperative preliminary results, mean time for LISA implantation is 12 (5) minutes, mean length of surgery is 58 (23) min and mean blood loss is 105
- (92) cc. Most of the patients are discharged home with lumbar support as prescribed medical equipment after discharge.

- As regards the surgical technique evaluation and with the information available to date, the mean global score is 92.2% (n=137; mean=92.2%±8.6%; minimal value=64.3%; maximal value=100%).
- In terms of safety preliminary results, to date, there was a total of 21 secondary surgical interventions (SSI) (removals, reoperations, and revisions): 2 were possibly related to the device and definitely related to the procedure (hematoma followed by infection, probably caused by a not sufficiently tightened LISA device; and persistent pain after implant insertion), 15 were definitely related to the procedure, 3 were possibly related to the procedure and 1 was neither related to the device nor the procedure.
- There were 3 different adverse device effects possibly related to the device (spinous process fracture, recurrence of initial symptoms and hematoma possibly caused by a not sufficiently tightened LISA device) for a total of 3 occurrences. As mentioned above, there were 2 LISA removal possibly due to the device. They all are expected side-effects and their occurrence is acceptable as regards the State of the Art.
- To date, global LISA survival rate is 99% at 3- and 6-months follow-up; 95% at 1-year follow-up and 91 % at 2-years follow-up. The success rate at 2-years, defined as successful LISA implantation without reoperation, revision or removal possibly related to the device is 98% (104/106).
- Furthermore, according to these preliminary results, the number of levels operated does not seem to impact the LISA safety results.

More details about the PMCF study are provided below :

Title	Post marketing prospective documentation of clinical outcomes (Post-operative, Safety and Performance) after lumbar dynamic stabilization surgery with LISA implant
Study reference	DHF-111-PMCF1-V11 – **March 2025**
Clinical Trials.gov ID	NCT04631133
Status	On going/ recruitment closed
Investigation Sites and investigators	• In France • CHU Pellegrin, Bordeaux – Principal Investigator : Vincent Pointillart

<table>
<tr><td></td><td>

Hôpital La Pitié Salpêtrière, Paris – Principal Investigator : Hugues Pascal-Moussellard
Clinique St Charles, Lyon – Principal Investigator : Mehdi Afathi

• In Denmark

Elective Surgery Center, Silkeborg Regional Hospital, Silkeborg Lyon – Principal Investigator : Søren Fruensgaard

• In Germany

Asklepios Stadtklinik, Bad Wildungen – Principal Investigator : Frank Maier

</td></tr>
<tr><td>Device under investigation</td><td>
<table>
<tr><th>Product Code</th><th>Device Name</th><th>MDR classification</th></tr>
<tr><td colspan="3">LISA Implants</td></tr>
<tr><td>BB-LISA-1-101</td><td>Band</td><td>Class III, rule 8</td></tr>
<tr><td>BB-LISA-1-104</td><td>Blocker</td><td>Class III, rule 8</td></tr>
<tr><td>BB-LISA-1-106</td><td>Spacer Size 6</td><td>Class III, rule 8</td></tr>
<tr><td>BB-LISA-1-108</td><td>Spacer Size 8</td><td>Class III, rule 8</td></tr>
<tr><td>BB-LISA-1-110</td><td>Spacer Size 10</td><td>Class III, rule 8</td></tr>
<tr><td>BB-LISA-1-112</td><td>Spacer Size 12</td><td>Class III, rule 8</td></tr>
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<table>
<tr><td>Trade Name</td><td colspan="2">LISA Dynamic Stabilization System (hereafter named LISA)</td></tr>
<tr><td>Device Family</td><td colspan="2">LISA Instruments</td></tr>
<tr><th>Product Code</th><th>Device Name</th><th>MDR classification</th></tr>
<tr><td>BB-LISA-2-206</td><td>Trial spacer LISA - Size 6</td><td>Class IIa, rule 6</td></tr>
<tr><td>BB-LISA-2-208</td><td>Trial spacer LISA - Size 8</td><td>Class IIa, rule 6</td></tr>
<tr><td>BB-LISA-2-210</td><td>Trial spacer LISA - Size 10</td><td>Class IIa, rule 6</td></tr>
<tr><td>BB-LISA-2-212</td><td>Trial spacer LISA - Size 12</td><td>Class IIa, rule 6</td></tr>
<tr><td>BB-LISA-2-213</td><td>Band Forceps I</td><td>Class Ir, rule 6</td></tr>
<tr><td>BB-LISA-2-214</td><td>Band Forceps II</td><td>Class Ir, rule 6</td></tr>
<tr><td>BB-LISA-2-215</td><td>Hook</td><td>Class Ir, rule 6</td></tr>
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	BB-LISA-2-220	Hook wide	Class Ir, rule 6
	BB-LISA-2-224	Implant Holder Size 6	Class Ir, rule 6
	BB-LISA-2-225	Implant Holder Size 8	Class Ir, rule 6
	BB-LISA-2-226	Implant Holder Size 10	Class Ir, rule 6
	BB-LISA-2-227	Implant Holder Size 12	Class Ir, rule 6
	BB-LISA-2-260	Interlaminar distractor	Class Ir, rule 6
	BB-LISA-2-228	Locker	Class I, rule 1
	BB-LISA-2-230	Tensioner	Class I, rule 1
	BB-LISA-2-240	Torque Limiting Handle	Class I, rule 1
	BB-LISA-2-241	Additional wrench	Class I, rule 1
	BB-LISA-2-242	Torque Limiting Connector	Class I, rule 1
	BB-LISA-2-250	Gripper Screwdriver	Class I, rule 1
	BB-LISA-2-300	Instruments Tray	Class I, rule 1

Intended use of the device under investigation	Please see section 2.1.
Objective of the study	The objective of this study is to confirm the safety and clinical performance of the LISA implant when used as intended.
Study Design	Multicenter, prospective, open label, post-market and non-interventional study
Schedule of clinical follow-up	• Screening/ enrollment visit (up to -30 days) • Surgery (day 0) • Follow up visit 1 (3 months post-operative) • Follow up visit 2 (6 months post-operative) • Follow up visit 3 (12 months post-operative) • Follow up visit 4 (24 months post-operative) • Follow up visit 5 (48 months post-operative) • Follow up visit 6/ Final Visit (72 months post-operative)
Primary endpoint	**For safety aspects:**

	LISA implant survival rate two years after surgery defined as successful LISA implantation without reoperation, revision, or removal **For performance aspects:** ODI change between pre-operative assessment (baseline value) and 2 years follow-up To Note: Primary endpoint will also be evaluated at 1-year follow-up
Secondary endpoints	<u>Intra- and postoperative:</u> • Duration of the surgery • Duration of the Implant placement • Blood loss • Surgical technique assessment • Hospitalization days • Time to return to normal activity (working) depending on the patient's profession (blue collar, white collar) <u>Safety</u> • Number of patients with: ○ reoperations ○ revision or removal at the operative level or on adjacent levels relating to the device and not the pathology ○ implant breakage (polyester band rupture) ○ migration or rupture of any implant component (Polyester band loose) ○ major unanticipated device related complications ○ post-operative scapular pain ○ recurrence of the initial symptoms, ○ degeneration of the adjacent segments ○ superficial infection ○ dural injury ○ bone fracture or bone erosion anywhere implant is in contact with the anatomy ○ Any other procedure or device related adverse events • Survival rate at the follow-up times other than at 1 and 2 years

	Clinical performance: • Oswestry Disability Index (ODI) at the follow-up times other than at 1 and 2 years • Visual Analogue Scale (VAS) for back and leg pain • Patient satisfaction with treatment assessment • Surgeon surgery outcome assessment • Radiological results (if available)
Inclusion criteria	• Skeletally mature patients Patient ≥18 years of age • Failed conservative treatment for low back pain conducted for at least 6 months • Patients with low-back pain caused by degenerative lesions of grade II, III and IV (Pfirrmann MRI classification).
Exclusion criteria	• Stage V degenerative disk lesions in Pfirrmann's MRI classification. • Spondylolisthesis. • Osteoporosis. • Non-specific back pain. • Modic 2 and Modic 3 changes. • This implant is not indicated for the L5/S1 segments. • Local or general infections that may compromise the surgical goals. • Major local inflammatory phenomena. • Pregnant and lactating women • Immunosuppressive diseases. • Bone immaturity. • Severe mental illnesses. • Bone metabolism diseases that may compromise the mechanical support expected from this type of implant. • Patient with worker's compensation, under litigation or on disability benefits • Excessive physical activities. • Patients deprived of their liberty in accordance with national regulations • Protected patients or patients not in a position to declare his or her consent in accordance with national regulations
Number of patients to be included	136

<table>
<tr><td>Number of patients included to date</td><td>142 (included 3 patients with off label use)</td></tr>
<tr><td>Recruitment period</td><td>April 2019 – June 2023</td></tr>
<tr><td>Main baseline charecteristics – Preliminary results</td><td>
<table>
<tr><th></th><th>Mean (SD)</th><th>Min.</th><th>Max.</th><th>n</th></tr>
<tr><td>Age at surgery (years)</td><td>55 (15)</td><td>19</td><td>82</td><td>139</td></tr>
<tr><td>Sex (Women), n(%)</td><td colspan="2">72 (52%)</td><td></td><td>139</td></tr>
</table>
</td></tr>
<tr><td>Study Methods – Analysis and report</td><td>
The primary safety and performance endpoint will be analyzed when all enrolled patients have completed the 1- and 2-year study visits.

2 years after surgery is the main study endpoint
1 year after surgery results will also be evaluated because literature data shows it is pertinent to evaluate performance and safety results at 1-year follow-up for lumbar dynamic stabilization systems.

These analyses will be confirmative. A Bonferroni correction for multiplicity will be applied.
Two confirmative additional analyses are planned at 4 and 6 years.

The hypotheses will be tested hierarchically for these 4 and 6 years analyses.

All other analyses of secondary endpoints and at other time points will be explorative (descriptive).
Furthermore, a final report will be generated after the last subject finished the study and after reviewing all data for correctness and plausibility. It will contain a description of the methodology and statistically data analysis.
The report will contain all data from all study participants in anonymous form. No subject will be identified in the report or in the eventually published results.
</td></tr>
</table>

	The detailed statistical plan of the LISA PMCF study is available in the document BF-131-RED-V03 SAP_LISA PMCF_V07_31032023.
Summary of preliminary results	Please note the study is still ongoing and the presented results are preliminary results. To date, 142/136 (>100%) patients have been included. The Table below gives details about the inclusion status and the follow-up in the study: **Table 1: Inclusion status and follow-up in the LISA PMCF study to date**

Centre	Preop. Assessment	Perop. Assess.	Postop Assessment				
			3 months	6 months	12 months	24 months	48 months
Bordeaux, France	59	59	59*	54*	51*	41*	22*
Paris, France	14	14	13*	12*	10*	8*	2*
Lyon, France	14	14	12*	12*	11*	8*	0*
Silkeborg, Denmark	17	17	17	17	17	16*	6*
Bad Wildunge, Germany	39	39	39	37	35*	33*	14*
TOTAL	142	142	139*	132*	124*	106*	44*

*: Data available according to the latest database update (March 2025)

To date, 139/136 patients have been included. 3 patients were included in offlabel use. Pre-operative and per-operative data are available for 136 patients. Then, data at 3-months follow-up, 6-months follow-up, 12-months follow-up, 24-months follow-up and 48-months follow-up are available for 139, 132, 124, 106 and 44 patients, respectively. Collected data at 48-months of follow-up have not been sufficiently monitored to be exploited at present for performance and safety results.

In terms of performance preliminary results, we can observe a decrease in ODI and VAS for back pain and leg pain in the 106 patients who have reached the 2-years follow-up as detailed in the figures below.

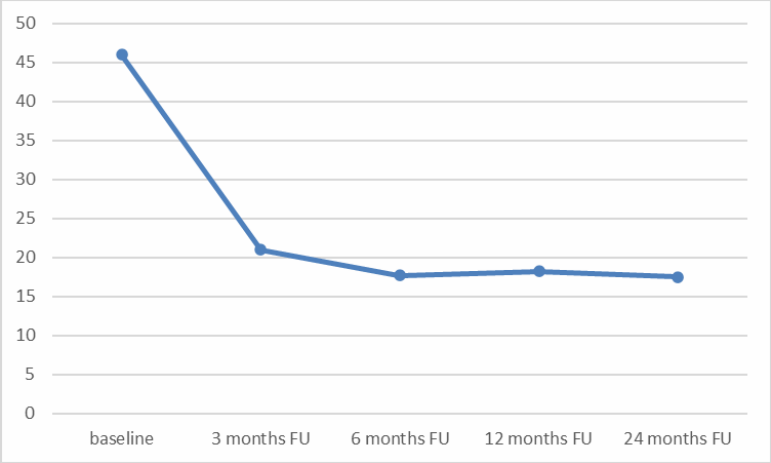

Figure 1: ODI evolution for LISA patients - Preliminary Results

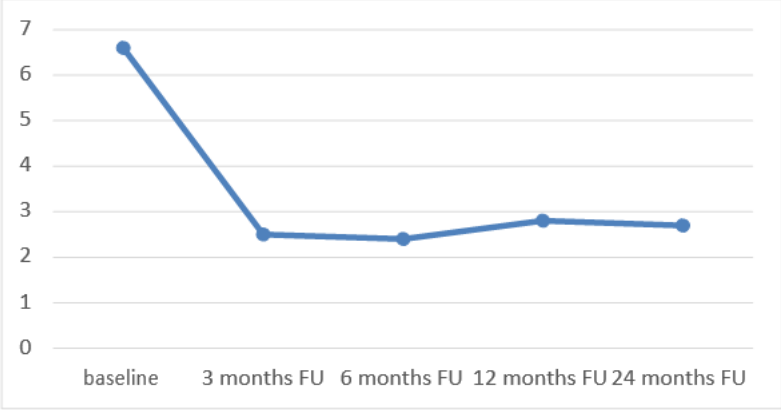

Figure 2: VAS for Back Pain for LISA patients who reached two-year follow-up (n=106) – Preliminary Results

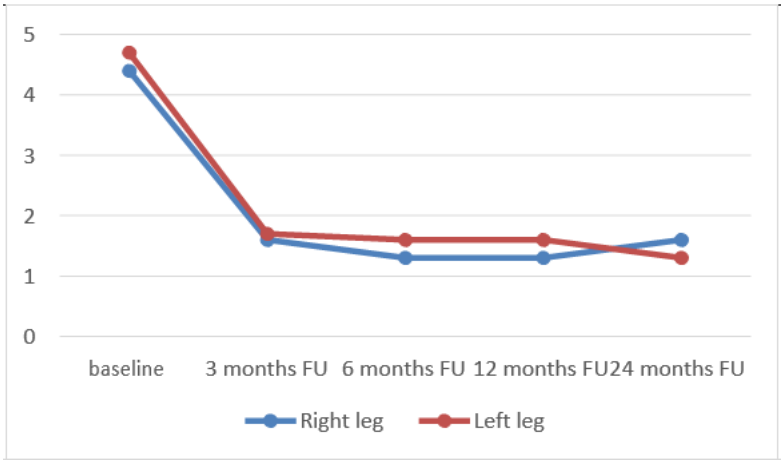

Figure 4: VAS for Leg Pain for LISA patients who reached two-year follow- (n=106) - Preliminary Results

ODI (Oswestry Disability Index) decreases from 45.6 (17.0) to 17.5 (16.4) from pre-operation to follow-up at 24 months

Concerning VAS (Visual Analogue Scale), results are:

- For back pain: decreases from 6.7 (2.4) to 2.7 (2.6) from pre-operation to follow-up at 24 months
- For right leg pain: decreases 4.8 (3.4) to 1.6 (2.7) from pre-operation to follow-up at 24 months
- For left leg pain: decreases from 4.8 (3.3) to 1.3 (2.3) from pre-operation to follow-up at 24 months
- Range of Motion is within a normal range at the operated level at 24 months follow-up (5.01° (2.85°)).

Surgeons report mean time for LISA surgery to be 58 minutes. It is less than the time used for a fusion (From 150 min to 290 min for decompression + fusion). Shorter time and minimally invasive technique may lead to less blood loss (mean blood loss is 105 cc in the LISA study/ mean blood loss for decompression + fusion is 349 cc) and post operative days at hospital (mean postoperative days at hospital is 2 in the LISA study and some patients return home the same day they were hospitalized/ for decompression + fusion they return home between 3 to 7 days).

With LISA, 85% of patients go home after surgery. Others go to extend care facilities (elder patients).

	The time for LISA implantation has been reported by surgeons to be 12 minutes as mean value (n=93; mean=12±5 minutes; minimal value=3 minutes; maximal value=35 minutes) whereas in the literature. Patients find it easier to carry out activities from day to day. They still have mobility at the operated levels. Regarding the surgical technique evaluation and with the information available to date, the mean global score is 92.2% (n=137; mean=92.2%±8.6%; minimal value=64.3%; maximal value=100%). In terms of safety preliminary results, in total, 18 SSI (removals, reoperations, and revisions) occurred during the LISA PMCF study: 2 were possibly related to the device and definitely related to the procedure (hematoma followed by infection, probably caused by a not sufficiently tightened LISA device; and persistent pain after implant insertion), 15 were definitely related to the procedure, 3 were possibly related to the procedure and 1 was neither related to the device nor the procedure. No malfunction, deterioration of the device and inadequacy in the product information were reported. There were 3 incidents related to undesirable-effects recorded in the PMCF study (spinous process fracture, recurrence of initial symptoms and hematoma possibly caused by a not sufficiently tightened LISA device) for a total of 3 occurrences. Two were considered as serious. As mentioned above, there were 2 LISA removals possibly due to the device. All these effects are expected and described in the product information. No new findings were reported. Considering the surgery, 36 adverse effects possibly or definitely related to the procedure occurred. All of them are well described in the state of the art of the procedure. To date, LISA survival rate is 99% at 3 months and 6 months follow-up; 95% at 1 year follow-up and 91% at 2 years follow-up. The success rate at 2-years, defined as successful LISA implantation without reoperation, revision or removal possibly related to the device is 98% (104/106).
Limitations of the study	One limitation of the study is that there is no control group. Other limtation of this study is that at the moment the study is still ongoing.

Any device deficiency and any device replacements related to safety and/or performance during the study.	During the course of the Post-Market Clinical Follow-up study, some design changes have been implemented to the LISA Implants Class III and LISA instruments. However, those changes do not have clinical impact.

5.3.2.3. Medical device registries

No relevant medical device registries with public data were identfiied during the literature review.

5.4 An overall summary of the clinical performance and safety

5.4.1 Summary of clinical performance – Overall

Clinical data supporting overall performance of the LISA Implant are described in Table 5.4.1-1.

Clinical data supporting overall clinical benefits of the LISA Implant are described in Table 5.4.1-2

Table 5.4.1-1 Performance Claims and Supporting Data

Intended Clinical Performance	Clinical Outcome Parameters	Benchmark Values based on State of the Art	LISA results	Intended clinical performance achieved ?
Mobility preservation after surgery	Range Of Motion (ROM)	At the operated level, ≥ 2 degrees in order to prove mobility[4]	OPERATED LEVEL At 6 months follow-up: 6.48° At 12 months follow-up: 6.78° At 24 months follow-up: 5.01°	Yes, there is mobility at the different follow-up assessments and within a range acceptable as regards to the State of the Art (mobility of 3 to 5 degrees(13,19,20) between 6 months follow-up and 24 months follow-up)
		At the superior adjacent level, ≥ 2 degrees in order to prove mobility[4]	SUPERIOR ADJACENT LEVEL At 6 months follow-up: 5.58° At 12 months follow-up: 7.02° At 24 months follow-up: 5.49°	Yes, there is mobility at the different follow-up assessments and within a range acceptable as regards to the State of the Art (mobility of 3 degrees at 24 months follow-up(20))

[4] When there is no mobility (e.g in the case of fusion), the ROM is equal to 0.

		At the inferior adjacent level, ≥ 2 degrees in order to prove mobility[4]	INFERIOR ADJACENT LEVEL At 6 months follow-up: 7.62° At 12 months follow-up: 7.16° At 24 months follow-up: 4.39°	Yes, there is mobility at the different follow-up assessments and within a range acceptable as regards to the State of the Art (mobility of 3 degrees at 24 months follow-up(20))
Protection of adjacent levels from degeneration (LISA *vs*. fusion)	Adjacent Segment Degeneration (ASD)	4.1% for patients with Wallis 2nd generation + fusion vs. 28.6% for patients with fusion only	0.7% (1/139) of ASD	Yes, only one ASD has been observed at the moment with LISA

The following clinical performances have been observed for patients operated with LISA:

- Mobility preservation after surgery at the operated, adjacent superior and inferior levels
- Protection of adjacent levels from degeneration

These clinical performances led to the clinical benefits described in Table 5.4.1-1.

Table 5.4.1-1 Clinical Benefits Claims and Supporting Data

Intended Clinical Benefit	Clinical Outcome Parameters	Benchmark Values based on State of the Art	LISA results	Intended clinical benefit achieved ?
Reduction of disability in daily activities (post-operative *vs*. pre-operative)	Oswestry Disability Index (ODI) score	≥ 15-point improvement in ODI between pre-operation and follow-up assessment	Improvement in ODI between pre-operation and follow-up assessment : • 25.1 points at 3 months follow-up • 28.4 points at 6 months follow-up • 27.9 points at 12 months follow-up • 28.5 points at 24 months follow-up	Yes – All ODI imrovements for LISA are ≥ 15-point at the following follow-up: 3-months; 6-months, 12-months and 24 months
Back pain reduction (post-operative *vs*. pre-operative)	Visual Analogue Scale (VAS) for back pain	Significant decrease of approximatively 3 points between pre-operative and 1 year follow-up assessment	Improvement in VAS for back pain between pre-operation and 1 year and 2 years follow-up: • 3.8 points at one year • 4.0 points at two years	Yes – Improvement in VAS for back pain at 1-year follow-up is acceptable when compared to values reported in the literature for similar devices. This improvement is confirmed at two years follow-up
Leg pain reduction (post-operative *vs*. pre-operative)	VAS for leg pain	Significant decrease of approximatively [2-4] points between pre-operative and 1 year follow-up assessment	Improvement in VAS for leg pain between pre-operation and 1 year and 2 years follow-up: • 3.5 points for right leg pain after one year and 3.2 points after two years follow-up • 3.2 points for left leg pain after one year and 3.5 points after two years follow-up	Yes - Improvement in VAS for leg pain at 1-year follow-up is acceptable when compared to values reported in the literature. This improvement is confirmed at two years follow-up
Satisfaction with treatment after operation	Satisfaction evaluation	At 2 years follow-up 89.5% satisfied vs. 10.5% unsatisfied	This value requires the analysis of consolidated data. The satisfaction evaluation will be performed with the intermediate analysis at 2 years planed for Q4/2026. At the moment, it is therefore not possible to conclude on that aspect.	No because lack of data at the moment but the PMCF study is still ongoing and will provide data on that aspect soon.

Postoperative symptoms improvement (post-operative *vs*. pre-operative)	Odom's criteria	At 2 years follow-up, excellent in 44% ; good in 48% ; fair in 8%	This value requires the analysis of consolidated data. The analysis of Odom's criteria will be performed with the intermediate analysis at 2 years planed for Q4/2026. At the moment, it is therefore not possible to conclude on that aspect.	No because lack of data at the moment but the PMCF study is still ongoing and will provide data on that aspect soon.
Blood loss (per-operative LISA vs. fusion)	Blood loss	Interspinous spacer *vs*. decompression + fusion : 109.7mL (120) vs. 348.6mL (281.8)	Mean blood loss for LISA surgery : 105 cc.	Yes – Blood loss during LISA surgery is acceptable when compared to blood loss during decompression + fusion
Surgery Length (per-operative LISA vs. fusion)	Surgery Length	From 150 min to 290 min for decompression + fusion	Time for LISA surgery : 58 minutes	Yes – Surgery length for LISA surgery is acceptable when compared to surgery length for decompression + fusion
Hospital stay (Post-operative LISA vs fusion)	Number of days at hospital after operation	From 3 days to 7 days for decompression + fusion	Number of days at hospital after LISA operation: 2 days in mean	Yes – Number of days at hospital after LISA operation is acceptable when compared to number of days at hospital after decompression + fusion

5.4.2 Summary of safety – overall

Clinical data supporting overall safety of the LISA Implant are described in Table 5.4.2-1.

Table 5.4.1-2 Safety Claims and Supporting Data

Safety Claims	Clinical Outcome Parameters	Supporting Clinical Data
Incidence of Residual clincial risks and side-effects acceptable in comparison with the State of the Art	Incidence of Residual clincial risks and side-effects	Please refer to sections 4.1.1 and 4.1.2.
LISA survival rate acceptable in comparison with similar devices	Survival rate	LISA survival rate is 99% at 3 and 6 months follow-up; 95% at 1 year follow-up and 91% at 2 year of follow-up which is similar to survival rates reported for Wallis 2nd generation and DIAM similar devices (1,18).

5.4.3 Representativeness of clinical data – overall

Main characteristics of patients and devices in the clinical data supporting overall device clinical performance and safety are as follows :

Table *5.4.3-1*: Age at surgery and sex of patients included in the LISA PMCF study and operated on

	Mean (SD)	Min.	Max.	n
Age at surgery *(years)*	55 (15)	19	82	139
Sex (Women), n(%)	72 (52%)			139

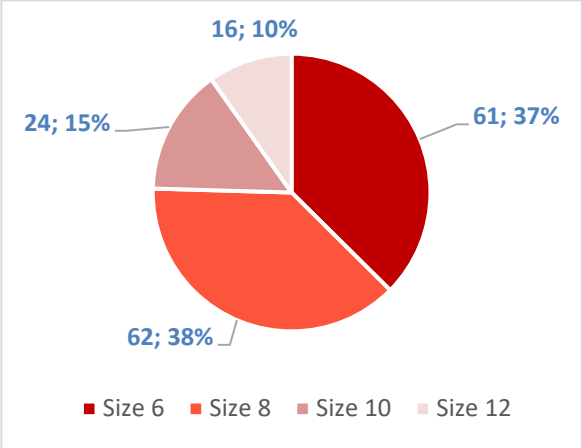

Figure *5.4.3-1*: Implant size used for the 139 surgeries performed within the LISA PMCF study at the moment (163 implants used in total)

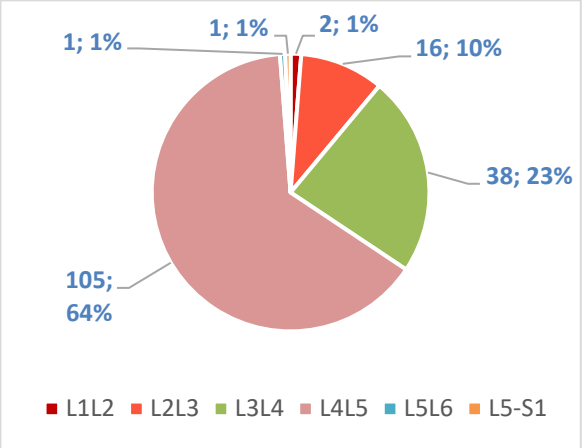

Figure *5.4.3-2*: Levels operated during the 139 surgeries performed within the LISA PMCF study at the moment

5.4.4 Benefit-risk assessment

In conclusion, the data provided in the sections above demonstrate that the benefit-risk ratio of the device is acceptable, based on the state of the art in medicine, for its indication and intended purpose.

Accordingly, it is concluded that the residual risks associated with the LISA Implants are low and acceptable taking into account the clinical benefits and are compatible with a high level of protection of health and safety.

All the reported side-effects inherent to the use of LISA are already described in the literature either for alternatives or similar technologies.

The side-effects identified in this evaluation are acceptable in regards to the state of the art and in comparison to alternatives.

5.5 Ongoing post-market clinical follow-up

Backbone has one ongoing and two planned PMCF studies that were put in hold in accordance with MDR Annex XIV Part B and its PMCF Plan.

- PMCF study ongoing

    - Purpose : Collect safety and performance data for complete device lifecycle of LISA Implant, including long-term data.
    - Aim :
        - confirming the safety of the medical device
        - confirming the performance of the medical device

- identifying previously unknown side-effects (related to the procedures or to the medical devices).
- monitoring the identified side-effects and contraindications
- identifying and analyzing emergent risks
- ensuring the continued acceptability of the benefit-risk ratio
- identifying possible systematic misuse or off-label use of the device

- Activity :
  - The study is ongoing in 5 european centers. 139/136 have been included. Preliminary results are available and detailed in section 5.3.2.2.

As part of the PMCF Plan, Backbone also implements general PMCF procedures and methods including :

- Gathering clinical experience through the collection of complaints and vigilance reports (annually) ;
- Conducting screening in scientific literature from several internationally recognized literature search databases/peer-reviewed articles (annually),
- Collecting publicly available PMS data from EU PMS databases/competent authorities' official sources (annually).

Results of activities conducted per the PMCF Plan will be documented in PMCF Evaluation Reports in accordance with MDR Annex XIV, Part B. The PMCF Evaluation Report will be updated regularly, and its conclusions shall be accounted for in the clinical evaluation of the LISA Implants. No emerging risks, complications or unexpected device failures were detected within the last PMCF Evaluation Report.

6. Possible diagnostic or therapeutic alternatives

Alternatives for the treatment of Degenerative Disc Disease or Lumbar stenosis with LISA include the following conservative and surgical options(21):

- Conservative treatments (pharmacological and non-pharmacological options) (6,7,22,23):
  - nonsteroidal anti-inflammatory medication (NSAIDS) (6,22,24)
  - epidural steroid injections(6,22,24)
  - braces for instability(22)
  - physical therapy(6,22,24); lifestyle modifications(25)
  - education and cognitive-behavioral treatments(23)

Note: When conservative treatment fails, surgery is more effective than continuing conservative treatment(26)

- ❖ Surgical approach (6):
  - decompression surgery of neural structure(6,24,27) including:

Note: Operative therapy has shown significantly better results than conservative management. Open decompression is the most frequent spinal operation for patients over 65 years with LSS(22)*].*

- laminectomy (24,28)
- lamina fusion (24) / laminotomy (28)
- discectomy (24)
- disc artroplasty (10,24) : In essence, disc arthroplasty that is expressed by TDR (total disc replacement) or TDA (total disc arthroplasty) consists in the implantation of an artificial disc of replacement to eliminate the disc material, reconstruct stability and interbody space motion through this "disc prothesis". This technique that started in early 90's and became a current procedure progressively FDA approved for 20 years (10)
- Minimally Invasive Lumbar Decompression (MLID) Procedure (29). MILD is a minimally invasive outpatient procedure to treat spinal stenosis due to hypertrophied ligamentum flavum.

- Lumbar fusion (6,10,24,30,31) : may also be required, if stenosis accompanied with degenerative spondylolisthesis or segmental instability (6,24). Spinal fusion has been shown to be beneficial for chronic low back pain secondary to fractures, persistent or complicated infections, progressive spinal deformity, and radiographically demonstrable instability with spondylolisthesis (32). According to Barrey et al. (33) , fusion may be offered to patients who have failed to respond to at least 1 year of non-operative treatment and who have been informed of the other treatment options, notably intensive rehabilitation therapy with cognitive behavioral therapy, whose functional outcomes as assessed by the ODI may be similar to those of fusion.

  Various approaches may be used including:

  - anterior lumbar inter-body fusion (ALIF) (31,33)
  - lateral interbody fusion by anterior approach is performed by placing a structural implant, such as a spacer, allograft, or cage, within the disc space after complete discectomy (30,33)

  - lateral interbody fusion by posterior or transforaminal approaches consists in the placement of inter body fusion are to create a solid fusion and

restore foraminal dimensions, coronal and sagittal balance, and disc space height (30,31,33)

- extreme lateral interbody fusion or XLIF (NuVasive), a minimally invasive lateral approach to anterior lumbar fusion with purported decreased approach – related complications and morbidity (30)
- circumferential lumbar fusion via a dual anterior and posterior approach (31,33)
- posterior lumbar interbody fusion (PLIF)
- minimally invasive interspinous-interlaminar fusion device such as the MinuteMan G3 (29).

No significant differences were found among fusion techniques (31).

- Lumbar disc replacement with an artificial implant (31): modern therapy to address herniation and other conditions, with the theoretical advantage of preserving spinal range of motion and mechanics. Current evidence to demonstrate the long-term efficacy and safety of this new therapy is limited in quantity. For now, the US FDA indications for disc replacement include patients ≤ 60 years of age with single-level pathology between L3 and S1 and no associated deformity, spondylolisthesis, or neurological deficit.

- Mini-invasive surgery with IPD (6,24,27,28)
- Interspinous process devices represent a large family of several devices. In a recently published book[6], Pr. Sénégas makes the distinction between interspinous dynamic stabilization systems and interspinous distraction devices and he states that "this fundamental difference in indications (dynamic stabilization versus distraction) is not always perceived by authors reporting on interspinous devices in the literature". The concept of "dynamic stabilization" was first described by Sengupta et al. who postulated that restoring the normal motion of the spine, rather than rigidly stabilizing, would decrease the risk of ASD by avoiding the abnormal loading patterns placed on the adjacent segments surrounding the fusion. Biomechanically, restoration of the normal motion allows the spine to naturally redistribute the aforementioned forces. In return, this method seeks to reduce pain, prevent ASD, and allow for natural disk restoration (9).

[6] Sénégas J. (2020) Systemic Approach to the Functioning of the Spine. In: Vital J., Cawley D. (eds) Spinal Anatomy. Springer, Cham. https://doi.org/10.1007/978-3-030-20925-4_29

- Interspinous dynamic stabilization systems

  They are developed with the aim of dynamic stabilization i.e. restoring, in degenerate intervertebral segments, the high-flexibility zone flexion-

extension stiffness, which is diminished in symptomatic degenerative disc disease and worsened by posterior decompressive surgery.

- interspinous distraction devices (IDD) (7):
  They act to separate adjacent spinous processes, thereby reducing compression of nerves during spinal extension

The Table below details the advantages/benefits and inconvenience/risks for each alternative for the treatment of Degenerative Disc Disease or Lumbar stenosis with LISA :

Treatment	Advantages / Benefits	Inconvenience / Risks
CONSERVATIVE TREATMENTS		
Conservative treatments (pharmacological and non-pharmacological options i.e. nonsteroidal anti-inflammatory medication (NSAIDS), epidural steroid injections, braces for instability, physical therapy; lifestyle modifications, education and cognitive-behavioral treatments)	- non-invasive treatments and low costs (e.g: physical therapy, NSAIDS, chiropractor) (26) - application of interlaminar epidural steroid injections provides short-term (two weeks to six months) relief of neurogenic claudication (21)	- For DDD (e.g. degenerative lumbar spondylosis) surgery is superior to conservative treatments in long term evaluation (22,34) - Long-term efficacy of interlaminar epidural steroid injections is controversial (21,26) - insufficient evidence to support the use of physical therapy/exercise/manipulation treatment or Medication therapy for spinal stenosis (4,21,35) - NSAIDS : gastrointestinal bleeds, liver failure, renal compromise (26) - Opioids: highly addictive, overdose (26) - Interspinous devices would provide better outcomes at 6 weeks, 6 months and one year for symptom severity and physical function (23)
SURGICAL APPROACHES		
Decompression in general (including laminectomy, lamina fusion,	- significant symptomatic improvement in neurological function(36) - pain relief(36)	- segmental spinal instability (36,37) - lumbar disc degeneration (37) with DH loss (37)

Treatment	Advantages / Benefits	Inconvenience / Risks
discectomy, vertebroplasty, minimally invasive decompression procedure)	- amelioration in quality of life(36) - recommendations from the NASS guidelines for moderate to severe symptoms because of lumbar spinal stenosis(35) - reduction of hospital stays (28)	- narrowing of intervertebral space (36) - recurrence (38) (lumbar disc herniation): 16.6% (5) - complication rate: 12.6% (36) with: o dural tears (5.9%) - Dural violation (37,38) o superficial infection (2.3%) (10); o deep infection (1.1%) (10); o perioperative mortality (0.3%); o deep vein thrombosis (2.7%) (27) o urinary tract infection (39) - reinterventions (26) - ASD (38,40) - New surgery: 9.4% (24) - for Minimally Invasive Lumbar Decompression (29) : - Bleeding, infection, and nerve injury - Dural tear and CSF leak - Incision-related pain
Lumbar fusion (e.g.anterior lumbar inter-body fusion, lateral interbody fusion by anterior/ posterior or transforaminal approach, extreme lateral interbody fusion, circumferential lumbar fusion,	- predictable outcomes (11) - low recurrence rate (11) - high lumbar spine stability (9,11) ; iatrogenic instability that may result from spinal decompression can be avoided (41)	- lack of reversibility (34) - loss of movement (9,11,34,42,43) - increase motion at the supradjacent segment (39) - ASD (9,11,25,36,37,42-45) with: lumbar spine instability, increased facet joint stress, and

Treatment	Advantages / Benefits	Inconvenience / Risks
Minimally invasive interspinous-interlaminar fusion device)	- improvement in neurological function (36) - improvement of pain relief (36) - amelioration of quality of life (36) - cost-effective for some healthcare sectors, such as direct healthcare costs, hospital care, primary care, medication usage, and community service (31)	subsequent symptoms such as lower back and radicular pain. 28.6% (13) 89% on supra-adjacent segment of fusion (39) while 3.7% in subadjacent segment (39) . - The annual incidence of surgery for adjacent-segment disease following posterior decompression and fusion (or open posterior lateral interbody fusion or circumferential fusion) has been reported to be 2.5% per year (25). Long-term clinical studies have reported the incidence of adjacent segmental degeneration (ASD) to be between 5 and 100% after undergoing lumbar spinal fusion (even if radiographic ASD is not always associated with clinical symptoms) (9) - Lumbar stiffness (36) - instrumentation failure (37,42,45) - pseudarthrosis (37,42,45) - clinical satisfaction rate (43) - non union, infection, donor site pain (45) - non-superiority with decompression in terms of clinical outcomes (46) - Spine instability (40) - Stenotic lesion (40) - disc herniation (3) - Dural laceration (3,47) - Infection (3)

Treatment	Advantages / Benefits	Inconvenience / Risks
		- Venous thrombosis (3) - Pseudarthrosis (37,42) - Significant loss of movement (11,34,42,43) - Deep hematoma (39)
- PLIF (posterior lumbar interbody fusion) – The most common technique of lumbar fusion	- Disc height maintenance (48) - Support of the anterior column (48) -immobilization of the unstable degenerated intervertebral disc area (48) - Decompression of the nerve roots (48) - Restoration of the lordosis (48) - Substantial increase in fusion rates (48)	- Dural laceration (47) - lumbar destabilization (48) - change of lumbar dynamics (48) - accelerated degeneration of adjacent segment (48) - spinal stenosis (48) - dural injury (48) - arachnoiditis by massive clinical observations (48) - more estimated blood loss, ROM at the proximal segment and operative time; less ROM at the surgical segment; similar performance and complications outcomes in comparison with IPD (48) - venous thrombus, intervertebral disc herniations, dura mater lacerations, screw malposition, infections and ASD (3)
Mini-invasive surgical technique in general	- decrease of blood loss 30) - lower infection rate (30) - less perioperative pain with similar post-operative complication rate with open procedures (30)	- specialized equipment (30) - training need (30) - learning curve to the surgeon (30)

Treatment	Advantages / Benefits	Inconvenience / Risks
	- reduce the surgical approach-related morbidity associated with conventional open procedures (30)	
- Interspinous devices They were designed to provide a stand-alone method of treating neurogenic claudication secondary to lumbar stenosis without disrupting the anterior and middle spinal column elements. Systems such as the original Wallis system (Abbott) and X-STOP (Medtronic) function through two key mechanisms. First, longitudinal distraction between posterior spinal elements is created at the symptomatic level to relieve neuroforaminal stenosis. Second, these devices generate a relative focal kyphosis between the two segments that reduces ligamentum flavum projection into the central canal. Together, these mechanisms work to increase central canal and neuroforaminal diameter while decreasing impingement on the traversing nerve roots by	- Flexion of the lumbar spine relieves the bulging of the ligamentum flavum leading to an increase in size of the central canal (10,34) - Increase of the Neural Foramina Area (10) - Reduction of ASD complications compared to fusion treatment (49) - Unload of the Posterior Annulus and Intradiscal Pressure (10) - Distraction of Interspinous Distance (10) - Strength of the Spinous Processes (10) - Dynamic stabilization devices lead to a small reduction of motion (34) - Patients undergoing IPD implantation typically experience initial reduction in symptomatology. Postoperatively, a steady rise in VAS has been reported to occur from 6 months to 3 years of FU depending on the published article (7) - IPD has been demonstrated to be more effective than conservative therapy (level 1) (35), it provides better pain and functional outcomes (49,50)	- recurrent lumbar disc herniation (11) - spinous process fracture (11,35) due to osteoporosis, over-distraction, inappropriately sized device selection, and poor surgical technique (6) - bone resorption of the spinous process (11) - implant displacement (14,35) - foreign body reaction to polyethylene (14) - when used alone: rate of complication from 0 to 11% with the highest rate for X-stop (4.8% to 11%) (14) - When used in combination with another treatment, rate of complication 0 to 32.3% (14) - intraoperative rate: 4.26% of patients with complications (6) (e.g. hematoma (52)) - revision surgery (14) (13.35% at 2 years of FU for: o Spinous fracture (6,14,52) o Device dislocation (6,52) o New radicular deficit(6)

Treatment	Advantages / Benefits	Inconvenience / Risks
hypertrophied soft tissue structures (25).	- Reversible if it produces insufficient relief (4) - IPD vs. decompression plus fusion: quicker operation, less blood loss, shorter hospital length, similar outcomes in pain reduction, quality of life, reoperation rates, slightly more effective on disability reduction (46) - Lowest operation time and intraoperative blood loss in comparison to other surgical interventions (28,51) - better reduction of long-term back pain in comparison to other surgical interventions (28)	○ Persistent post-operative symptoms (6) (e.g. neurologic symptom (52)) - Failure of IPD at 60 months FU: 33.8% due to ○ loosening, breakage, or migration in 3.7% (6) ○ deep infection (6,52) in 0.9% (6) ○ spinous process fracture or erosion (6,11,39,52) in 5.1% (6) ○ wound complications in 14% (6) new or worsening pain in 33% (6) - Low evidence in literature for making a recommendation as regards to the use of these devices in case of lumbar stenosis (lack of sufficient RCT and/or studies with sufficient long-term follow-up) (44,48,53) - Low to moderate quality evidence: IPDs have similar outcomes and complication rates than decompression but higher rates of reoperation (46,49,50,53) (lack of conclusive evidence) (50,53) - Longer operation time for IPD vs. decompression but no difference in hospital stay and perioperative blood loss (46) - Higher reoperation rate than laminotomy (51) - spinous process fracture, device dislocation or malposition, dura mater tears with cerebrospinal

Treatment	Advantages / Benefits	Inconvenience / Risks
		fluid leakage, infection, hematoma, erosion of the spinous process, heterotopic ossification, deep venous thrombosis, and neurologic sequelae (9) - ASD (27) - Neurologic symptoms (52) - Delayed infection (52) - Wound complications in 14% (6) - New surgery: 28.8% (24) - Hematoma (52,54)

7. Suggested profile and training for users

LISA devices must be implanted by surgeons who have been properly trained in spinal surgery. The decision to implant them should be made only after taking into consideration the medical and surgical indications, contraindications, side effects and precautions contained in the Instructions For Use and the limitations of this type of surgery.

Before the first LISA surgery takes place in one hospital/clinic, Backbone provides to the hospital/clinic the LISA surgical technique and takes time to train the surgeon(s) and/or medical staff of the hospital/clinic about all the steps of the surgical technique (on site or through visioconference). Also, when this is possible, one BACKBONE representative is present during the first LISA surgery performed in each hospital/clinic. After this first surgery, the surgeon is asked to answer to a usability evaluation form. The objective of this form is the evaluation of the 23 steps of the surgical technique and for the surgeon to state if she/he had a good understanding or not, of each step. If a step is not clear, training is performed again, until the step be clear. Then, the BACKBONE representative also evaluates the global efficiency of the training. A report of the surgery is also provided by BACKBONE representative.

8. Reference to any harmonised standards and CS[5] applied

No Common Specifications (CS) applicable to the LISA Implants have been issued by the MDCG at this time. There are limited harmonized standards under the MDR at this time. Harmonized standards under the consolidated Medical Devices Directive 93/42/EEC (MDD) are highlighted in

[5] MDR Art. 1 (71) : 'common specifications' means a set of technical and/or clinical requirements, other than a standard, that prov/2018ides a means of complying with the legal obligations applicable to a device, process or system.

italic text. If a more recent version of the standard has been published, this version will be considered as representing the current state-of-the-art.

Table 8-1 provides the list of standards claimed for compliance of the LISA Implants with the GSPR of the MDR.

Table 8-1 List of Standards Applied

Standard Number/Year/Revision	**Standard Title**	**Applied**
N°6/2021/Rev1	N° 6 : EN ISO 10993-9:2021 - Évaluation biologique des dispositifs médicaux — partie 9: Cadre pour l'identification et la quantification des produits potentiels de dégradation (ISO 10993-9:2019)	In full
N°7/2021/Rev1	N° 7 EN ISO 10993-12:2021 - Évaluation biologique des dispositifs médicaux — Partie 12: Préparation des échantillons et matériaux de référence (ISO 10993-12:2021)	In full
N°8/2018/Rev1	N° 8. EN ISO 11737-1:2018 - Stérilisation des produits de santé — Méthodes microbiologiques — Partie 1: Détermination d'une population de microorganismes sur des produits (ISO 11737-1:2018) - EN ISO 11371-1 :2018/A1 :2021	In full
N°10/2016/Rev1	N°10. EN ISO 13485:2016 - Dispositifs médicaux — Systèmes de management de la qualité — Exigences à des	In full

	fins réglementaires (ISO 13485:2016) - EN ISO 13485:2016/A11:2021	
N°12/2021/Rev1	N° 12. EN ISO 15223-1:2021 - Dispositifs médicaux — Symboles à utiliser avec les informations à fournir par le fabricant — partie 1: Exigences générales (ISO 15223-1:2021)	In full
N°13/2021/Rev1	N° 13. EN ISO 17664-1:2021 - Traitement de produits de soins de santé — Informations relatives au traitement des dispositifs médicaux à fournir par le fabricant du dispositif — partie 1: Dispositifs médicaux critiques et semi-critiques (ISO 17664-1:2021)	In full
N°16/2019/Rev1	N°16. EN ISO 14971: 2019 Dispositifs médicaux – Application de la gestion des risques aux dispositifs médicaux (ISO 14971: 2019) - EN ISO 14971:2019/A11:2021	In full

9. Bibliographic References

1. Nicholson JA, Scott CEH, Duckworth AD, Burke JG, Gibson JNA. Survival analysis of the Wallis interspinous spacer used as an augment to lumbar decompression. Br J Neurosurg. déc 2017;31(6):688-94.
2. Boody BS, Smucker JD, Sasso W, Miller JW, Snowden R, Sasso RC. Evaluation of DIAM™ Spinal Stabilization System for lower lumbar disc degenerative disease: A randomized, prospective, single-site study. J Orthop. oct 2020;21:171-7.
3. Mo Z, Li D, Zhang R, Chang M, Yang B, Tang S. Comparative effectiveness and safety of posterior lumbar interbody fusion, Coflex, Wallis, and X-stop for lumbar degenerative diseases: A systematic review and network meta-analysis. Clin Neurol Neurosurg. sept 2018;172:74-81.
4. Deer TR, Grider JS, Pope JE, Falowski S, Lamer TJ, Calodney A, et al. The MIST Guidelines: The Lumbar Spinal Stenosis Consensus Group Guidelines for Minimally Invasive Spine Treatment. Pain Pract Off J World Inst Pain. mars 2019;19(3):250-74.
5. Zhou Z, Jin X, Wang C, Wang L. Wallis interspinous device versus discectomy for lumbar disc herniation : A comparative study. Orthopade. févr 2019;48(2):165-9.
6. Pintauro M, Duffy A, Vahedi P, Rymarczuk G, Heller J. Interspinous implants: are the new implants better than the last generation? A review. Curr Rev Musculoskelet Med. juin 2017;10(2):189-98.
7. Pham MH, Mehta VA, Patel NN, Jakoi AM, Hsieh PC, Liu JC, et al. Complications associated with the Dynesys dynamic stabilization system: a comprehensive review of the literature. Neurosurg Focus. janv 2016;40(1):E2.
8. Cho HJ, Ko YS, Won YI, Lee CH, Yang SH, Kim CH, et al. The Efficacy of Lumbar Hybrid Fusion for the Prevention of Adjacent Segment Disease: Fact or Artifact? A Meta-analysis. Clin Spine Surg. 9 oct 2020;
9. Porrino J, Rao A, Moran J, Wang A, Grauer J, Haims A, et al. Current concepts of spondylosis and posterior spinal motion preservation for radiologists. Skeletal Radiol. nov 2021;50(11):2169-84.
10. Chopko B, Liu JC, Khan MK. Anatomic surgical management of chronic low back pain. Neuromodulation J Int Neuromodulation Soc. oct 2014;17 Suppl 2:46-51.
11. Wang K, Zhu Z, Wang B, Zhu Y, Liu H. Bone resorption during the first year after implantation of a single-segment dynamic interspinous stabilization device and its risk factors. BMC Musculoskelet Disord. 14 mai 2015;16(1):117.
12. Krappel F, Brayda-Bruno M, Alessi G, Remacle JM, Lopez LA, Fernández JJ, et al. Herniectomy versus herniectomy with the DIAM spinal stabilization system in patients with sciatica and concomitant low back pain: results of a prospective randomized controlled multicenter trial. Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc. mars 2017;26(3):865-76.
13. Korovessis P, Repantis T, Zacharatos S, Zafiropoulos A. Does Wallis implant reduce adjacent segment degeneration above lumbosacral instrumented fusion? Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc. juin 2009;18(6):830-40.
14. Lee SH, Seol A, Cho TY, Kim SY, Kim DJ, Lim HM. A Systematic Review of Interspinous Dynamic Stabilization. Clin Orthop Surg. sept 2015;7(3):323-9.
15. Sénégas J. Mechanical supplementation by non-rigid fixation in degenerative intervertebral lumbar segments: the Wallis system. Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc. oct 2002;11 Suppl 2:S164-169.
16. Sénégas J, Vital JM, Pointillart V, Mangione P. Clinical evaluation of a lumbar interspinous dynamic stabilization device (the Wallis system) with a 13-year mean follow-up. Neurosurg Rev. juill 2009;32(3):335-41; discussion 341-342.
17. Gornet MF, Bailey AS, Eltahawy HA, Sasso RC, Cheng WK, Palmer S, et al. 250. Interspinous process

distraction compared to nonoperative care for moderate lumbar degenerative disc disease: results of the FDA IDE clinical trial. Spine J. 1 sept 2019;19(9, Supplement):S122-3.
18. Sur YJ, Kong CG, Park JB. Survivorship analysis of 150 consecutive patients with DIAM™ implantation for surgery of lumbar spinal stenosis and disc herniation. Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc. févr 2011;20(2):280-8.
19. Daentzer D, Hurschler C, Seehaus F, Noll C, Schwarze M. Posterior dynamic stabilization in the lumbar spine - 24 months results of a prospective clinical and radiological study with an interspinous distraction device. BMC Musculoskelet Disord. 18 févr 2016;17:90.
20. Jia YH, Sun PF. Preliminary evaluation of posterior dynamic lumbar stabilization in lumbar degenerative disease in Chinese patients. Chin Med J (Engl). janv 2012;125(2):253-6.
21. Deer T, Sayed D, Michels J, Josephson Y, Li S, Calodney AK. A Review of Lumbar Spinal Stenosis with Intermittent Neurogenic Claudication: Disease and Diagnosis. Pain Med Malden Mass. 1 déc 2019;20(Suppl 2):S32-44.
22. Sobottke R, Schlüter-Brust K, Kaulhausen T, Röllinghoff M, Joswig B, Stützer H, et al. Interspinous implants (X Stop, Wallis, Diam) for the treatment of LSS: is there a correlation between radiological parameters and clinical outcome? Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc. oct 2009;18(10):1494-503.
23. Zaina F, Tomkins-Lane C, Carragee E, Negrini S. Surgical Versus Nonsurgical Treatment for Lumbar Spinal Stenosis. Spine. 15 juill 2016;41(14):E857-68.
24. Zhao XW, Ma JX, Ma XL, Li F, He WW, Jiang X, et al. Interspinous process devices(IPD) alone versus decompression surgery for lumbar spinal stenosis(LSS): A systematic review and meta-analysis of randomized controlled trials. Int J Surg Lond Engl. mars 2017;39:57-64.
25. Deer TR, Sayed D, Malinowski MN, Rowe JJ, Jameson JB, Liang K, et al. A Review of Emerging Evidence for Utilization of a Percutaneous Interspinous Process Decompression Device to Treat Symptomatic Lumbar Adjacent-Segment Degeneration. Pain Med Off J Am Acad Pain Med. déc 2019;20(Suppl 2):S9-13.
26. Cairns K, Deer T, Sayed D, van Noort K, Liang K. Cost-effectiveness and Safety of Interspinous Process Decompression (Superion). Pain Med Malden Mass. 1 déc 2019;20(Suppl 2):S2-8.
27. Gazzeri R, Galarza M, Alfieri A. Controversies about interspinous process devices in the treatment of degenerative lumbar spine diseases: past, present, and future. BioMed Res Int. 2014;2014:975052.
28. Ge Y, Lu Y, Ma C, Lu B, Ma E, Zhang Y, et al. Effect of Different Interventions on Lumbar Spinal Stenosis: A Systematic Evaluation and Network Meta-Analysis. World Neurosurg. févr 2025;194:123459.
29. Kaye AD, Edinoff AN, Temple SN, Kaye AJ, Chami AA, Shah RJ, et al. A Comprehensive Review of Novel Interventional Techniques for Chronic Pain: Spinal Stenosis and Degenerative Disc Disease—MILD Percutaneous Image Guided Lumbar Decompression, Vertiflex Interspinous Spacer, MinuteMan G3 Interspinous-Interlaminar Fusion. Adv Ther. 1 sept 2021;38(9):4628-45.
30. Aguwa OK, Park DK. Indirect spinal decompression for lumbar stenosis. Semin Spine Surg 25. 2013;274-82.
31. Giraldo JP, Williams GP, Lee JJ, Potts EA, Uribe JS. An evidence-based review of the current surgical treatments for chronic low-back pain: rationale, indications, and novel therapies. J Neurosurg Spine. 1 févr 2025;1-12.
32. Senegas J, Vital JM, Pointillart V, Mangione P. Long -term actuarial survivorship analysis of an interspinous stabilization system. Eur Spine J. 2007;1279-89.
33. Barrey CY, Le Huec JC, French Society for Spine Surgery. Chronic low back pain: Relevance of a new classification based on the injury pattern. Orthop Traumatol Surg Res OTSR. avr 2019;105(2):339-46.
34. Marsh GDJ, Mahir S, Leyte A. A prospective randomised controlled trial to assess the efficacy of dynamic stabilisation of the lumbar spine with the Wallis ligament. Eur Spine J Off Publ Eur Spine Soc

Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc. oct 2014;23(10):2156-60.
35. Zini C, Bellini M, Masala S, Marcia S. Percutaneous Interspinous Spacer in Spinal-Canal-Stenosis Treatment: Pros and Cons. Medicina (Mex) [Internet]. 16 juill 2019 [cité 3 mars 2021];55(7). Disponible sur: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6681403/
36. Chen Z, Peng B, Li D, Pang X, Yang H. Minimum 5-year follow-up study on the effects of the Wallis dynamic stabilization system in the treatment of lumbar degenerative disease. Chin Med J (Engl). 2014;127(20):3587-91.
37. Gu H, Chang Y, Zeng S, Gao Y, Zhan S, Zheng Q. Efficacy of the Wallis interspinous implant for primary lumbar disc herniation : a prospective randomised controlled trial. Acta Orthop Belg. sept 2017;83(3):405-15.
38. Gu H, Chang Y, Zeng S, Zheng X, Zhang R, Zhan S, et al. Wallis Interspinous Spacer for Treatment of Primary Lumbar Disc Herniation: Three-Year Results of a Randomized Controlled Trial. World Neurosurg. déc 2018;120:e1331-6.
39. Korovessis P, Syrimpeis V, Tsekouras V, Vardakastanis K, Fennema P. PEEK versus Silicon Interspinous Spacer for Reduction of Supradjacent Segment Degeneration following Decompression and Short-Segment Instrumentation for Degenerative Lumbar Spinal Stenosis. Adv Orthop [Internet]. 8 août 2018 [cité 3 mars 2021];2018. Disponible sur: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6106718/
40. Zhou Z, Xiong W, Li L, Li F. Adjacent segmental degeneration following Wallis interspinous stabilization implantation. Medicine (Baltimore) [Internet]. 2 juin 2017 [cité 2 mars 2021];96(22). Disponible sur: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5459735/
41. Crawford RJ, Malone QJ, Price RI. Change of sagittal spinal alignment and its association with pain and function after lumbar surgery augmented with an interspinous implant. Scoliosis Spinal Disord. 2017;12:2.
42. Jiang Y qi, Che W, Wang H ren, Li R yu, Li X lei, Dong J. Minimum 5 year follow-up of multi-segmental lumbar degenerative disease treated with discectomy and the Wallis interspinous device. J Clin Neurosci Off J Neurosurg Soc Australas. juill 2015;22(7):1144-9.
43. Pan B, Zhang ZJ, Lu YS, Xu WG, Fu CD. Experience with the second-generation Wallis interspinous dynamic stabilization device implanted in degenerative lumbar disease: a case series of 50 patients. Turk Neurosurg. 2014;24(5):713-9.
44. Roitberg B, Zileli M, Sharif S, Anania C, Fornari M, Costa F. Mobility-Preserving Surgery for Lumbar Spinal Stenosis: WFNS Spine Committee Recommendations. World Neurosurg X. juill 2020;7:100078.
45. Wang H, Peng J, Zeng Q, Zhong Y, Xiao C, Ye Y, et al. Dynesys system vs posterior decompression and fusion for the treatment of lumbar degenerative diseases. Medicine (Baltimore). 22 mai 2020;99(21):e19784.
46. Machado GC, Ferreira PH, Yoo RI, Harris IA, Pinheiro MB, Koes BW, et al. Surgical options for lumbar spinal stenosis. Cochrane Database Syst Rev. 1 nov 2016;11:CD012421.
47. Yue ZJ, Liu RY, Lu Y, Dong LL, Li YQ, Lu EB. Middle-period curative effect of posterior lumbar intervertebral fusion (PLIF) and interspinous dynamic fixation (Wallis) for treatment of L45 degenerative disease and its influence on adjacent segment degeneration. Eur Rev Med Pharmacol Sci. déc 2015;19(23):4481-7.
48. Cai Y, Luo J, Huang J, Lian C, Zhou H, Yao H, et al. Interspinous spacers versus posterior lumbar interbody fusion for degenerative lumbar spinal diseases: a meta-analysis of prospective studies. Int Orthop. juin 2016;40(6):1135-42.
49. Li M, Yang H, Wang G. Interspinous process devices for the treatment of neurogenic intermittent claudication: a systematic review of randomized controlled trials. Neurosurg Rev. oct 2017;40(4):529-36.

50. Poetscher AW, Gentil AF, Ferretti M, Lenza M. Interspinous process devices for treatment of degenerative lumbar spine stenosis: A systematic review and meta-analysis. PloS One. 2018;13(7):e0199623.
51. Wei FL, Zhou CP, Liu R, Zhu KL, Du MR, Gao HR, et al. Management for lumbar spinal stenosis: A network meta-analysis and systematic review. Int J Surg Lond Engl. janv 2021;85:19-28.
52. Ravindra VM, Ghogawala Z. Is There Still a Role for Interspinous Spacers in the Management of Neurogenic Claudication? Neurosurg Clin N Am. juill 2017;28(3):321-30.
53. Filippiadis DK, Marcia S, Ryan A, Beall DP, Masala S, Deschamps F, et al. New Implant-Based Technologies in the Spine. Cardiovasc Intervent Radiol. oct 2018;41(10):1463-73.
54. Ramesh A, Lyons F, Kelleher M. Aperius interspinous device for degenerative lumbar spinal stenosis: a review. Neurosurg Rev. avr 2016;39(2):197-205; discussion 205