SUMMARY OF SAFETY AND CLINICAL PERFORMANCE (SSCP) *RESUME DES CARACTERISTIQUES DE SECURITE ET DES PERFORMANCES CLINIQUES (RCSPC)*		SPINEVISION
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Hexanium® ACIF

SUMMARY OF SAFETY AND CLINICAL PERFORMANCE

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CHANGE SUMMARY

Revision	Date	Justification	Revision Validated by the Notified Body
A	15/11/2022	Document creation	☐ Yes Validation language: English ☒ No
B	24/02/2023	Revision according to the TÜV SÜD clinical deficiency report #713277737 of the 2023-02-03 for Hexanium® ACIF	☐ Yes Validation language: English ☒ No
C	16/10/2023	Change of company name to "SPINEVISION SAS"	☐ Yes Validation language: English ☒ No
D	12/02/2024	Update of Basic UDI-DIs. Update of the list of harmonized standards applicable (chapter 9 of SSCP for HCP)	☐ Yes Validation language: English ☒ No
E	22/04/2024	Revision of the list of harmonized standards applicable according to the commission implementing decision (EU) 2024/815 of 6 March 2024.	☒ Yes Validation language: English ☐ No
F	13/06/2024	Deletion of "Bâtiment E" in the address	☒ Yes Validation language: English ☐ No
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APPROVAL SIGNATURES

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SSCP FOR USERS AND OR HEALTHCARE PROFESSIONALS

1. OBJECTIVE

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 device.

The SSCP is not intended to replace the Instructions for Use (IFU) 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.

Following this information there is a summary intended for patients.

2. DEVICE IDENTIFICATION AND GENERAL INFORMATION

MANUFACTURER	
Name	SPINEVISION SAS
Address	3 rue de la Renaissance 92160 Antony – France
Single Registration Number (SRN)	FR-MF-000001549
NOTIFIED BODY	
Name	TÜV SÜD
Single Identification Number	0123
PRODUCT	
Device trade name	Hexanium® ACIF
Basic UDI-DI	3663136ACIFSCRWT8 for screws 3663136ACIFCAGEM9 for cages
Medical Device Nomenclature Description/text	P09070101: Spinal cages P09070199: Spinal fusion systems – Others
Class of device	Class III
Year when the first certificate (CE) was issued covering the device	2019 (MDD)

3. INTENDED USE OF THE DEVICE

A. INTENDED PURPOSE

The Hexanium® ACIF (Anterior Cervical Interbody Fusion) system is intended as a standalone intervertebral body fusion device of the cervical spine (C3-C7). It is intended to be implanted via an anterior approach to give a primary stability of the cervical column (with or without restoring disc height) until fusion occurs.

B. INDICATION(S) AND TARGET POPULATION(S)

The Hexanium® ACIF (Anterior Cervical Interbody Fusion) system is an intervertebral body fusion device indicated for use in:

- Patients with Degenerative Disc Disease (DDD) at one level from C3 to C7 of the cervical spine, and up to 2 consecutive levels.
- Patients with DDD who may also have symptoms of radiculopathy and/or myelopathy, or spondylosis at the involved level(s) and must be resistant to conservative management.

Hexanium® ACIF is intended to be used in skeletally mature patients, regardless of gender.

C. CONTRAINDICATIONS AND/OR LIMITATIONS

This device is not intended for thoracic or lumbar spine use.
Contraindications include:

- infection, local to the operative site, signs of local inflammation, leukocytosis;
- fever;
- morbid obesity (BMI ≥ 40 kg/m^2);
- pregnant women;
- pediatric cases, or patient still having general skeletal growth;
- spondylolisthesis unable to be reduced to Grade I;
- suspected or documented allergy or intolerance to metal;
- any case where the implant components selected for use would be too large or too small to achieve a successful result;
- any patient having inadequate tissue coverage over the operative site or inadequate bone stock or quality;
- any patient in which implant utilization would interfere with anatomical structures or expected physiological performance;
- prior fusion at the level to be treated;
- any case not needing a bone graft or fusion;
- any abnormality present which affects the normal process of bone remodeling including, but not limited to, severe osteoporosis involving the spine, bone absorption, osteopenia, primary or metastatic tumors involving the spine, active infection at the site or certain metabolic disorders affecting osteogenesis;
- any other condition which would preclude the potential benefit of spinal implant surgery, such as the presence of tumors or congenital abnormalities, fracture local to the operating site, elevation of segmentation rate unexplained by other diseases, elevation of white blood count (WBC), or a marked left shift in the WBC differential count;
- patient's inability to follow practitioner recommendations;
- any patient unwilling to cooperate with postoperative instructions.

Implants are not designed, or intended, or sold for uses other than those indicated. These contraindications must be taken into account by the physician when making his decision.

4. DEVICE DESCRIPTION

A. DESCRIPTION OF THE DEVICE

The Hexanium® ACIF consists of a 3D-printed, honeycomb cage containing a single-step screw blocking system made of two bone screws for standalone intervertebral body fusion of the cervical spine (C3-C7).

The Hexanium® ACIF cages are available in two different endplate shapes (lordotic [6°] and convex [6°]), various heights (5, 6, 7, 8, 9, 10, 11 and 12 mm), as well as various widths and depths (width x depth: 15 x 12 mm, 17 x 14 mm and 19 x 15 mm).
The Hexanium® ACIF screws are available in various lengths (10, 12, 14 and 16 mm) and diameters (3.5 mm and 3.8 mm). The orientation of the endplate screws is: 38° cranial/caudal, 10° lateral/medial.

The cages are composed of a plain part and a honeycomb structure with holes width of 1 mm. On both upper and bottom surfaces there are several rows of teeth with a height of 0.25 mm. The rugosity of the surface is 6.4 µm.

All cages and bone screws are manufactured from implant grade Titanium (Ti6Al4V ELI compliant with ASTM (American Society for Testing and Materials) F3001 and F136, respectively).

Of note, Hexanium® ACIF implants do not contain any substance which may be considered as a medicinal substance, nor a human blood derivative, and are not manufactured using tissues of animal origin.

Hexanium® ACIF implants are provided sterile.

B. PREVIOUS GENERATION(S) OR VARIANT

No previous generation or variant is claimed for the Hexanium® ACIF. However, similar devices were identified during the clinical evaluation: Zero-P, Depuy and Scarlet AC-T, Spineart. These devices are comparable to Hexanium ACIF and have similar clinical benefits.

C. DESCRIPTION OF ACCESSORIES INTENDED TO BE USED IN COMBINAISON WITH THE DEVICE

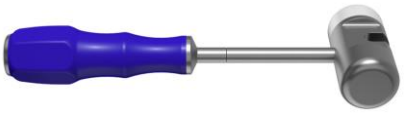
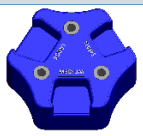
No accessories are intended to be used in combination with the device.

D. DESCRIPTION OF DEVICES AND PRODUCTS INTENDED TO BE USED IN COMBINATION WITH THE DEVICE

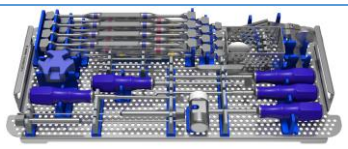
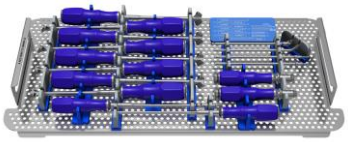
Hexanium® ACIF cage shall be used with a range of associated instruments to the cage. They are provided with the Hexanium® ACIF cage for any surgical procedure (Table 1).

Table 1: Instruments intended to be used to implant Hexanium® ACIF cages

REFERENCE	DESIGNATION	DESCRIPTION	PICTURE
INSTRUMENTS FOR DISTRACTION			
AC2-A206	Pins for Distractor / Compressor	*Spread 2 or several adjacent vertebrae during disc removal.*	
AC2-A216	Driver for Pins		
AC2-A201	Distractor / Compressor		
AC2-A214	Hexagonal Tip for Distractor / Compressor		
AC2-A210	Plug for Pins		

REFERENCE	DESIGNATION	DESCRIPTION	PICTURE
INSTRUMENTS FOR ENDPLATES' PREPARATION			
AC2-A010	Rasp	*To prepare disc space.*	
INSTRUMENTS FOR IMPLANT CHOICE			
AC2-A023	Mallet	*To enable an easy removal of trials during the cage sizing steps.*	
INSTRUMENTS FOR GRAFT FILLING			
AC2-A020	Ti Cervical Cage Graft Packing Block	*To fill and compress bone graft or bone substitute into the cage ex situ.*	
AC2-A021	Ti Cervical Cage Cancellous Bone Impactor		
INSTRUMENTS FOR CAGE INSERTION			
AC2-A001	Ti Cervical Cage Holder	*To ensure steady implant/instrument interconnection into the intervertebral space to ensure translational and rotational stability.*	
AC2-A001G	Ti SA Cervical Cage Holder with Guide		
AC2-A002	Inner Shaft for Ti SA Cervical Cage Holder		
AC2-A003	Ti Cervical Cage Holder Without Stop		
INSTRUMENT FOR CAGE REPOSITIONING			
AC2-A022	Ti Cervical Cage Repositioner	*To enable the repositioning of the implant after inserter removal.*	
INSTRUMENT FOR SCREWS INSERTION			

REFERENCE	DESIGNATION	DESCRIPTION	PICTURE
AC2-A030	Bone Awl	*To establish the trajectory and ensure proper placement of the screws.*	
AC2-A031	Angulated Bone Awl		
AC2-A038	Short Angulated Bone Awl		
AC2-A032	Straight Drill		
AC2-A033	U-Joint Drill		
AC2-A039	Short U-Joint Drill		
SD-ALSH26123PCAO	Cylindrical Snap-On Handle		
INSTRUMENT FOR SCREWS INSERTION			
AC2-A034	Screwdriver	*To insert the screws.*	
AC2-A035	U-Joint Screwdriver		
AC2-A037	Screwdriver Shaft		
AC2-A040	Short U-Joint Screwdriver		
SD-ALSH26123PCAOTL13	Cylindrical Snap-On Torque Limiting Handle		
INSTRUMENTS FOR CONTAINING THE INSTRUMENTS			

REFERENCE	DESIGNATION	DESCRIPTION	PICTURE
SD-BASE11117	SV Common Base DIN 1/1 H117 mm	*To contain trays.*	
SD-LID11	SV Common Lid DIN 1/1		
AC2-TRAY111	Ti Standard Tray	*To hold standard instruments.*	
AC2-TRAY112	Ti SA Tray	*To hold SA instruments.*	
AC2-ID	Hexanium® ACIF Identification Plate	*To identify the container.*	

In order to select the size and height of the cage that best corresponds to the intervertebral space of the patient undergoing the surgery, the surgeon has the possibility to use trials cages. They are also provided with the Hexanium® ACIF cage for any surgical procedure (Table 2).

Table 2: Trials cages used to select size and height of the cage to be implanted

REFERENCE	DESIGNATION	DESCRIPTION	PICTURE
TRIALS FOR CAGE CHOICE			
AC2-A011-xxxx	Ti Cervical Cage Trial	*To check the disc space and determine the reference of the cage to use.*	
AC2-A012-xxxx	Ti Cervical Cage Trial Without Stop	*To check the disc space and determine the reference of the cage to use.*	

5. RISKS AND WARNINGS

A. RESIDUAL RISKS AND UNDESIRABLE EFFECTS

Some risks associated with non-instrumented spinal surgery have been identified in the state-of-the-art and are described below:

- hemorrhage of blood vessels and/or hematomas;
- disc disruption or degeneration above, or below the level of surgery;
- dysphagia;

- deep venous thrombosis, thrombophlebitis;
- development of respiratory problems, e.g. pulmonary embolism, atelectasis, bronchitis, pneumonia, etc.;
- urinary retention or loss of bladder control or other types of urological system compromise;
- change in mental status; incapacity to resume the activities of normal everyday life;

In addition to the risks associated with spinal surgery without instrumentation, the following potential adverse events can occur:

(i) adverse events related to the device:

- foreign body reaction due to the implants including possible tumor formation, autoimmune disease, metallosis, and/or scarring;

(ii) adverse events related to the device and instrumented surgery:

- delayed union;
- non-union (or pseudoarthrosis);
- bone fracture or stress shielding at, above, or below the level of surgery, microfracture, resorption, or damage of any spinal bone (including pedicles, and/or vertebral body) and/or bone graft or bone graft harvest site;
- retropulsed graft;
- loosening, or migration of implant, that may result in paralysis, neurological disorders or blood vessel erosion due to the proximity of the device;
- loss of neurological function, appearance of radiculopathy, dural tears, and/or development of pain, neurovascular compromise including paralysis, or other types of serious injury, cerebral spinal fluid leakage;
- injury of muscular or neurological structures;
- infection;
- discitis, arachnoiditis, and/or other types of inflammation;
- subsidence of implant into adjacent vertebral bodies resulting in loss of height and possible impingement of neural structures;
- loss of proper spinal curvature, correction, height, and/or reduction;
- pain, discomfort, or other abnormal sensations due to the presence of the device;
- herniated nucleus pulposus,
- adjacent level degenerative changes;
- loss of or increase in spinal mobility or function;
- pressure on the surrounding tissues or organs;
- scar formation possibly causing neurological compromise or compression around nerves and/or pain;
- stenosis;

(iii) adverse events related to instrumented surgery

- bone graft donor site complication;
- death;

Note: Some potential adverse events may require an additional surgical revision procedure and may increase the operative time.

Note: The Hexanium® ACIF has not been evaluated for safety and compatibility in the MRI environment. The Hexanium® ACIF has not been tested for heating or migration in the MRI environment.

Quantitative data

The following table details the expected frequencies of the identified residual risks and undesirable side effect based on a systematic review of the scientific literature of non-equivalent similar devices and from the general state-of-the-art.

Potential Clinical Hazards and Undesirable Side Effects	Non-equivalent similar device	General state-of-the-art
Screw displacement, loosening, or fracture	1.2% - 3.2% Source: Barbagallo 2013, Yang 2017, Yun 2017	*Not reported*
Device malposition	1.2% Source: Barbagallo 2013	Not reported
Adjacent segment degeneration/disease	Not reported	General: 3% - 6.34% At ten years: 25.6% Source: Chung 2021
Adjacent level ossification development	1.6% and 2.9% Source: Yang 2015, Chen 2016	Not reported
Damage to neuro-vascular structures	Observed but no rate reported Source: Chung 2021	Observed but no rate reported Source: Chung 2021
Death from unknow cause	Observed but no rate reported Source: Njoku 2014	Observed but no rate reported Source: Njoku 2014
Dysphagia	3.7% to 44.6% Source: Azab 2012, Barbagallo 2013, Chen 2013, Fransen 2019; Njoku 2014, Noh 2018, Vanek 2013, Wang 2014, Wang 2015, Wang 2017, Yang 2015, Zhang 2016, Qi 2013, Scholz 2011, Shen 2018, Shi 2016, Shi 2016, Yang 2016	Not reported
C5 palsy	Not reported	0% - 19% Source: Takase 2020
Enlargement of existing osteophyte	2.9% Source: Shi 2016	Not reported
Horner syndrome	0.02% - 4.04% Source: Lubelski 2020	Not reported
Leak of cerebrospinal fluid	1.5% - 4.3% Source: Qi 2013, Shi 2016b, Zhang 2016	Not reported
Non-union causing persistent left arm pain	2.4% Source: Njoku 2014	Not reported
Recurrent laryngeal nerve	Not reported	1% - 11% Source: Johnson 2020
Pseudarthrosis	Observed but no rate reported	Observed but no rate reported
Superficial wound infection	1.3% - 4.3% Source: Azab 2012, Fransen 2019, Zhang 2016	Not reported
Subsidence	1.5% - 8.6% Source: Lee 2015, Noh 2018, Njoku 2014, Shen 2018, Shi 2016	21% Source: Noordhoek
Surgical site hematoma	1.2% Source: Barbagallo 2013	Not reported

Potential Clinical Hazards and Undesirable Side Effects	Non-equivalent similar device	General state-of-the-art
Transient hoarseness	1.3% - 11.1% Source: Azab 2012, Njoku 2014, Zhang 2016	Not reported

B. WARNINGS AND PRECAUTIONS

PREOPERATIVE

- The surgeon must be aware of not only the medical and surgical aspects of the implant, but also of the material limitations of titanium implants. The patient must be instructed in the limitations of the implant, especially with regard to the weight bearing and other body stresses on the device before a solid fusion occurs. The patient must be instructed that non-compliance with postoperative instructions could lead to failure of the device. The patient must be instructed that device failure could lead to the need for additional surgery to remove failed components.
- **Only patients that meet the criteria described in the indications should be selected and patients corresponding to the aforementioned contra-indications should not be selected. The following factors may be of importance when selecting patients for internal stabilization devices:**
  - foreign body sensitivity;
  - certain degenerative diseases;
  - senility, unable to understand/unwilling to follow physician's instructions, alcoholism, or drug abuse;
  - obesity;
  - patient's occupation or activity level;
  - smoking.
- Additional sterile components should be available in case of any unexpected need**.**

INTRAOPERATIVE (Please see surgical technique GAC2-ST, latest applicable version at SPINEVISION SAS)

- Correct handling of the implants is extremely important. The implants must be transported in a way not to incur any damage. The implants must not be scratched and must not collide during handling.
- Care must be taken when picking up the Hexanium® ACIF implants, filling it with bone graft and inserting it between the vertebral bodies. Alterations may produce defects in surface finish and may become the focal point for eventual breakage of the implant or for decreased efficacy in withstanding post-operative migration (e.g. when teeth of implant are damaged).
- Correct selection of the implant size is extremely important. The chance of adequate stabilization is increased by the selection of the proper size of the implant regarding the anatomy and conditions of the patient. Proper selection of the implant can minimize, but not eliminate risks.
- The Hexanium® ACIF components have been designed for use with this system. Do not use the Hexanium® ACIF with any components not specifically recommended, or with any components from another manufacturer.
- The Hexanium® ACIF cannot be inserted via a posterior approach.
- The Hexanium® ACIF cannot be used in thoracic and lumbar spine.
- The implant should be placed on the peripheral cortical bone of the endplates to minimize the risk of post-operative subsidence.
- Surgical implants must never be reused. An explanted implant should never be reimplanted. Even though a device appears undamaged, it may have small defects and internal stress patterns that may lead to early breakage.

POSTOPERATIVE

- Careful patient monitoring for the first two to four months following the operation is very important while the fusion mass matures and becomes able to share load with the implant. Adequately instruct the patient in the appropriate postoperative care. The patient must be instructed to reduce stress on the implants in order to avoid clinical problems that may accompany failed fixation. The patient's ability and willingness to follow instructions are one of the most important aspects of successful bone healing. The patient must be instructed in the limitations of the implant, and that physical activity and full weight bearing may cause premature failure of internal stabilization devices by migrating, loosening or fracture. The patient must be instructed that an implant does not have the strength of normal healthy bone, and that device failure may occur if excessive loading is placed on the implant. An active, debilitated, or demented patient who is unable to use orthotic weight bearing devices may be particularly at risk.
- No internal stabilization device can withstand activity levels equal to those withstood by normal healthy segment. No implant can be expected to withstand unsupported weight-bearing stress indefinitely.
- Implants may fail when subjected to the increased loading associated with delayed union or non-union. Internal stabilization devices are intended as load-sharing devices until normal healing occurs. If normal healing does not occur or is delayed, the device may break due to fatigue. Patients should be informed of the risks of implant failure**.**

C. OTHER RELEVANT ASPECTS OF SAFETY (i.e., FSCA/FSN)

Since the device is on the market, an FSCA has been established for Hexanium® ACIF in 2021 (Table 3)

Table 3 : FCSA list for the Hexanium® ACIF since its CE marking

DATE	REFERENCE	FSCA TYPE	DESCRIPTION
23/11/2021	R2111654 (ANSM reference)	Recall	There was no proven incident. This action is taken following an improvement proposed by SpineVision in order to better appreciate the end of travel of the screw when the surgeon places it in the Hexanium® ACIF cage.

This action has been taken by SPINEVISION SAS to make sure that the old versions of Hexanium® ACIF are no longer on the market and leave only the new versions. The safety and performance of the device are not compromised.

6. SUMMARY OF CLINICAL EVALUATION AND POST-MARKET CLINICAL FOLLOW-UP

A. SUMMARY OF CLINICAL DATA RELATED TO EQUIVALENT DEVICE (IF APPLICABLE)

N/A. No equivalent device was claimed, current clinical data is based on Hexanium® ACIF.

B. SUMMARY OF CLINICAL DATA FROM PRE-MARKET CLINICAL INVESTIGATION(S)

N/A. There were no specific clinical investigations performed on the device before CE-marking.

C. SUMMARY OF CLINICAL DATA FROM OTHER SOURCES

N/A. Clinical data on Hexanium® ACIF can be generated and held by the manufacturer or can be found in the literature. In the clinical evaluation report associated to Hexanium® ACIF, clinical data was

generated by a Post-Market Clinical Follow-Up (PMCF) study related to the study device. No publication related to Hexanium® ACIF was found in the literature.

D. AN OVERALL SUMMARY OF THE CLINICAL PERFORMANCE AND SAFETY

SPINEVISION SAS claims that Hexanium® ACIF system provides immediate stabilization of unstable spinal segments, promote a surface area for bony ingrowth while having the biomechanical properties to support the axial skeleton, and maintains interbody space and cervical lordosis.

Based on the preliminary results of the Hexanium® ACIF PMCF study (SV004), it was shown that:

- Hexanium® ACIF system provides immediate stabilization of unstable spinal segments to all patients evaluated during follow-up visits except one at 12-month post-procedure.
- Hexanium® ACIF system promotes fusion, indeed fusion was already total in 7.7% of patient at 2 months, then 28.8% of patients at 6 months, 65.9% at 12 months and 100% at 24 months (7/7 patients with available data).
- Patients treated with Hexanium® ACIF system showed improvement in the Neck Disability Index (NDI) score at 12-month post-procedure with also a reduction of their neck and arm pain.

These preliminary results showed promising data that tend to confirm the clinical performance claimed for Hexanium® ACIF.

Safety claims for the Hexanium® ACIF system are the following: biocompatible; solid (i.e., resistant to breakage/tear); limited complications associated with the use of the Hexanium® ACIF system.

Based on the preliminary results of the Hexanium® ACIF PMCF study (SV005), it was confirmed that:

- Hexanium® ACIF system is biocompatible: verified following biocompatibility testing conducted by SPINEVISION SAS, according to the standards. Device biocompatibility was also confirmed through the absence of adverse reaction to the device reported during PMS and PMCF activities.
- Hexanium® ACIF system is solid: verified through PMS and PMCF activities as no device breakage/fracture, screw loosening or cage migration have been reported to date.
- The use of Hexanium® ACIF does not lead to more complications compared to those observed in the literature.

The clinical data and clinical evidence are sufficient to demonstrate the clinical safety and performance of Hexanium® ACIF.

E. ONGOING OR PLANNED POST-MARKET CLINICAL FOLLOW-UP

SPINEVISION SAS has implemented a PMCF study since device CE marking under MDD requirements.

Hexanium® ACIF PMCF study (SV004) is an ambispective, non-interventional, multicentric, post-market clinical follow-up study. The objective of the study is to confirm the safety and performance of Hexanium® ACIF in the treatment of patients suffering from DDD of the cervical spine (C3-C7).

The first patient was treated on August 13th of 2020 (date of the index procedure) and the first patient registered in the study was in July 2021 (date of patient's non-opposition acknowledged). Patients have clinical follow-ups at 2-, 6-, 12- and 24-month<s post-procedure.

Patients' inclusion is now completed with a total of 144 patients included in 6 centers. Clinical follow-ups are still ongoing.

7. POSSIBLE DIAGNOSTIC OR THERAPEUTIC ALTERNATIVES

Theoretically, some treatment goals can be reached by conservative (nonsurgical) methods and they are generally the first choice for treatment. Conservative treatment options include:

- Medicines: Non-steroidal anti-inflammatory drugs (NSAIDs) and acetaminophen, anti-depressants, anti-epileptics, capsaicin, creams and ointments, lidocaine patches, colchicine, systemic corticosteroids, skeletal muscle relaxants, opioids

- Physical therapy and exercise
- Manipulation/ chiropractics
- Epidural steroid injections
- Ancillary treatments such as bracing, traction, electrical stimulation, acupuncture, and transcutaneous electrical stimulation

As an alternative to the anterior approach for cervical fusion, the posterior approach can also be performed. Posterior Percutaneous Full-Endoscopic Keyhole cervical Foraminotomy (PPEKF) was developed as an alternative to the conventional posterior cervical fusion approach to avoid complications caused by open surgery.

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Recently in the literature, the hybrid surgery that combines CDA with fusion has emerged as an effective alternative intervention for the treatment of multilevel cervical spondylosis to preserve cervical range of motion and reduce the risk of adjacent disc degeneration.

Transcorporeal tunnel approach is a relatively new alternative to ACDF that aim to remove part of a cervical vertebral body preserving the intervertebral disk to achieve cervical decompression. According to the literature, this approach seems to be a safe and efficient option for the treatment of cervical radiculopathy and myelopathy, but being a relatively new technique, further controlled studies are required to confirm the results.

8. SUGGESTED PROFILE AND TRAINING FOR USERS

The use of the Hexanium® ACIF shall be performed by a trained orthopedic surgeon or neurosurgeon familiar with spine surgery as well as with the operating techniques relating to these implants.

9. REFERENCE TO ANY HARMONISED STANDARDS APPLIED

The list of standards below contains the harmonised standards applied under Directive 93/42/EEC and the list of harmonized standards applied under regulation (EU) 2017/745.

Class	Reference	Description	Publication year
Quality Management	EN ISO 13485	Medical devices - Quality management systems - Requirements for regulatory purposes	2016
Risk Management	EN ISO 14971	Medical devices - Application of risk management to medical devices	2019
Manufacturing	EN ISO 15223-1	[Labelling] Medical devices - Symbols to be used with medical device labels, labelling and information to be supplied - Part 1: General requirements	2021
Manufacturing	EN ISO 11607-1	[Packaging] Packaging for terminally sterilized medical devices - Part 1: Requirements for materials, sterile barrier systems and packaging systems	2020
Manufacturing	EN ISO 11607-2	[Packaging] Packaging for terminally sterilized medical devices - Part 2: Validation requirements for forming, sealing and assembly processes	2019
Manufacturing	EN ISO 11137-1	[Sterilization] Sterilization of health care products - Radiation - Part 1: Requirements for development, validation and routine control of a sterilization process for medical devices	2015
Manufacturing	EN ISO 11137-2	[Sterilization] Sterilization of health care products - Radiation - Part 2: Establishing the sterilization dose	2015
Manufacturing	EN ISO 11737-1	[Sterilization] Sterilization of health care products - Microbiological methods - Part 1: Determination of a population of microorganisms on products	2018
Manufacturing	EN ISO 11737-2	[Sterilization] Sterilization of health care products - Microbiological methods - Part 2: Tests of sterility performed in the definition, validation and maintenance of a sterilization process	2020
Biocompatibility	EN ISO 10993-10	Biological evaluation of medical devices Part 10: Tests for skin sensitization	2023
Biocompatibility	EN ISO 10993-12	Biological evaluation of medical devices Part 12: Sample preparation and reference materials	2021
Biocompatibility	EN ISO 10993-17	Biological evaluation of medical devices Part 17: Toxicological risk assessment of medical device constituents	2023
Biocompatibility	EN ISO 10993-18	Biological evaluation of medical devices Part 18: Chemical characterization of medical device materials within a risk management process	2020
Biocompatibility	EN ISO 10993-23	Biological evaluation of medical devices Part 23: Tests for irritation	2021

A summary of the safety and clinical performance of the device, intended for patients, is given below.

SSCP PATIENTS

PROJECT INFORMATION	
SSCP Report Reference	*SSCP_ACIF_R-RA81_rev_G*
Document Revision	*G*
Date issued	*19/08/2024*

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 device. The information presented below is intended for patients or lay persons. A more extensive summary of its safety and clinical performance prepared for healthcare professionals is found in the first part of this document.

The SSCP is not intended to give general advice on the treatment of a medical condition. Please contact your healthcare professional in case you have questions about your medical condition or about the use of the device in your situation. This SSCP is not intended to replace an Implant card or the Instructions for Use to provide information on the safe use of the device.

1. DEVICE IDENTIFICATION AND GENERAL INFORMATION

MANUFACTURER	
Name	SPINEVISION SAS
Address	3 rue de la Renaissance 92160 Antony – France
PRODUCT	
Device trade name	Hexanium® ACIF
Basic UDI-DI	3663136ACIFSCRWT8 for screws 3663136ACIFCAGEM9 for cages
Year when the device was first CE-marked	2019 (MDD)

2. INTENDED USE OF THE DEVICE

A. INTENDED PURPOSE

The Hexanium® ACIF (Anterior Cervical Interbody Fusion) system is intended as a standalone intervertebral body fusion device of the cervical spine (C3-C7). It is intended to be implanted via an anterior approach to give a primary stability of the cervical column (with or without restoring disc height) until fusion occurs.

B. INDICATION(S) AND INTENDED PATIENT GROUP(S)

The Hexanium® ACIF (Anterior Cervical Interbody Fusion) system is an intervertebral body fusion device indicated for use in:

- Patients with Degenerative Disc Disease (DDD) at one level from C3 to C7 of the cervical spine, and up to 2 consecutive levels.
- Patients with DDD who may also have symptoms of radiculopathy and/or myelopathy, or spondylosis at the involved level(s) and must be resistant to conservative management.

Hexanium® ACIF is intended to be used in skeletally mature patients, regardless of gender.

C. CONTRAINDICATIONS

This device is not intended for thoracic or lumbar spine use.

Contraindications include:

- infection, local to the operative site, signs of local inflammation, leukocytosis;
- fever;
- morbid obesity (BMI ≥ 40 kg/m^2);
- pregnant women;
- pediatric cases, or patient still having general skeletal growth;
- spondylolisthesis unable to be reduced to Grade I; (forward sliding of a vertebra in relation to the vertebra immediately below)
- suspected or documented allergy or intolerance to metal;
- any case where the implant components selected for use would be too large or too small to achieve a successful result;
- any patient having inadequate tissue coverage over the operative site or inadequate bone stock or quality;
- any patient in which implant utilization would interfere with anatomical structures or expected physiological performance;
- prior fusion at the level to be treated;
- any case not needing a bone graft or fusion;
- any abnormality present which affects the normal process of bone remodeling including, but not limited to, severe osteoporosis involving the spine, bone absorption, osteopenia, primary or metastatic tumors involving the spine, active infection at the site or certain metabolic disorders affecting osteogenesis;
- any other condition which would preclude the potential benefit of spinal implant surgery, such as the presence of tumors or congenital abnormalities, fracture local to the operating site, elevation of segmentation rate unexplained by other diseases, elevation of white blood count (WBC), or a marked left shift in the WBC differential count;
- patient's inability to follow practitioner recommendations;
- any patient unwilling to cooperate with postoperative instructions.

Implants are not designed, or intended, or sold for uses other than those indicated. These contraindications must be taken into account by the physician when making his decision.

3. DEVICE DESCRIPTION

A. DEVICE DESCRIPTION AND MATERIAL/SUBSTANCES IN CONTACT WITH PATIENTS TISSUES

The Hexanium® ACIF system consists of a cage and two bone screw of various widths and heights (Figure 1 and Figure 2), which can be inserted between two vertebral bodies (Figure 3 and Figure 4) of C3-C7 segment (upper back) to give support and correction during cervical interbody fusion surgeries.

Hexanium® ACIF cage is exclusively composed of Titanium alloy which is biocompatible (tolerated by the body). Only the titanium is in contact with the patient's tissues.

Figure 1: Visual of Hexanium® ACIF cages without screws

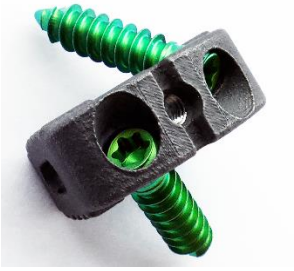

Figure 2 : Visual of Hexanium® ACIF cages with screws

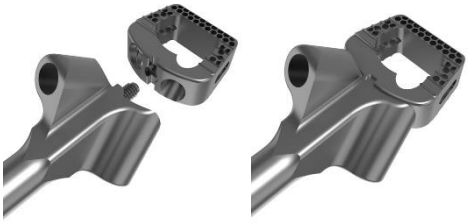

Figure 3 : Connection of the Hexanium® ACIF cage to the instrumentation for implantation

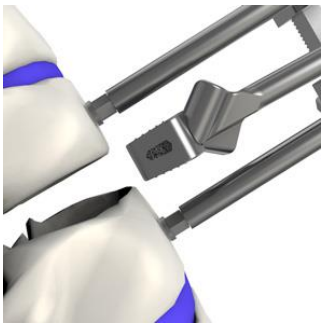

Figure 4: Insertion of the Hexanium® ACIF cage into the intervertebral space

B. INFORMATION ABOUT MEDICINAL SUBSTANCES IN THE DEVICE, IF ANY

Hexanium® ACIF cage does not contain medicinal substances. Therefore, no medicinal substance is in contact with the patient's tissues.

C. DESCRIPTION OF HOW THE DEVICE IS ACHIEVING ITS INTENDED MODE OF ACTION

Hexanium® ACIF implant cages are intended to maintain the primary stability of the cervical column until fusion occurs, which should occur within the first 24 months after the implantation.
After fusion has occurred, Hexanium® ACIF implant cages are intended to be left in place as they are embedded in the newly formed bone.
Teeth present on the surfaces of the Hexanium® ACIF implant cages contribute to prevention of the back out of the cages. The hollow geometry of the cages allows them to be packed with bone graft. (The choice of the type of bone graft will always be the surgeon's responsibility.) The 3D-printed honeycomb structure allows bone on-growth and in-growth.

D. DESCRIPTION OF ACCESSORIES, IF ANY

No accessories are intended to be used in combination with the device.

4. RISKS AND WARNINGS

Contact your healthcare professional if you believe that you are experiencing side-effects related to the device or its use or if you are concerned about risks.
This document is not intended to replace a consultation with your healthcare professional if needed.

A. HOW POTENTIAL RISKS HAVE BEEN CONTROLLED OR MANAGED

In order to control potential risks that could arise when using Hexanium® ACIF cage, SPINEVISION SAS decided to use risk control methods as indicated in ISO 14971.
These control methods consist of:

- Use of medically safe products in design and manufacture
- Protective measures in the medical device itself or in the manufacturing process
- information for safety and, where appropriate, training to users

B. REMAINING RISKS AND UNDESIRABLE EFFECTS

Some risks associated with non-instrumented spinal surgery have been identified in the state-of-the-art and are described below:

- Hemorrhage (leakage of blood from blood vessels) of blood vessels and/or hematomas;
- disc disruption or degeneration above, or below the level of surgery;
- dysphagia (feeling of discomfort or obstruction to the progress of food during swallowing);
- deep venous thrombosis, thrombophlebitis;
- development of respiratory problems, e.g. pulmonary embolism, atelectasis, bronchitis, pneumonia, etc.,
- urinary retention or loss of bladder control or other types of urological system compromise;
- change in mental status; incapacity to resume the activities of normal everyday life;

In addition to the risks associated with spinal surgery without instrumentation, the following potential adverse events can occur:

(i) adverse events related to the device:

- foreign body reaction due to the implants including possible tumor formation, autoimmune disease, metallosis, and/or scarring;

(ii) adverse events related to the device and instrumented surgery:

- delayed union (when a bone fails to unite within an average anticipated time);
- non-union or pseudoarthrosis (Complete and definitive failure of a fracture to heal after normal time limits);

- bone fracture or stress shielding at, above, or below the level of surgery, microfracture, resorption, or damage of any spinal bone (including pedicles, and/or vertebral body) and/or bone graft or bone graft harvest site;
- retropulsed graft;
- loosening, or migration of implant, that may result in paralysis, neurological disorders or blood vessel erosion due to the proximity of the device;
- loss of neurological function, appearance of radiculopathy, dural tears, and/or development of pain, neurovascular compromise including paralysis, or other types of serious injury, cerebral spinal fluid leakage;
- injury of muscular or neurological structures;
- infection;
- discitis, arachnoiditis, and/or other types of inflammation;
- subsidence of implant into adjacent vertebral bodies resulting in loss of height and possible impingement of neural structures;
- loss of proper spinal curvature, correction, height, and/or reduction;
- pain, discomfort, or other abnormal sensations due to the presence of the device;
- herniated nucleus pulposus,
- adjacent level degenerative changes;
- loss of or increase in spinal mobility or function;
- pressure on the surrounding tissues or organs;
- scar formation possibly causing neurological compromise or compression around nerves and/or pain;
- stenosis;

(iii) adverse events related to instrumented surgery

- bone graft donor site complication;
- death;

Note: Some potential adverse events may require an additional surgical revision procedure and may increase the operative time.

Quantitative data

Based on standalone intervertebral body fusion device's recognized undesirable side-effects/adverse events (USEs/AEs) and complications identified within the state of the art, it is possible that Hexanium ACIF may be associated with the following undesirable side effects:

Potential Clinical Hazards and Undesirable Side Effects	Non-equivalent similar device	General state-of-the-art
Screw displacement, loosening, or fracture	1.2% - 3.2% Source: Barbagallo 2013, Yang 2017, Yun 2017	*Not reported*
Device malposition	1.2% Source: Barbagallo 2013	*Not reported*
Adjacent segment degeneration/disease	*Not reported*	General: 3% - 6.34% At ten years: 25.6% Source: Chung 2021
Adjacent level ossification development	1.6% and 2.9% Source: Yang 2015, Chen 2016	*Not reported*
Damage to neuro-vascular structures	Observed but no rate reported Source: Chung 2021	Observed but no rate reported Source: Chung 2021
Death from unknow cause	Observed but no rate reported Source: Njoku 2014	Observed but no rate reported

Potential Clinical Hazards and Undesirable Side Effects	Non-equivalent similar device	General state-of-the-art
		Source: Njoku 2014
Dysphagia	3.7% to 44.6% Source: Azab 2012, Barbagallo 2013, Chen 2013, Fransen 2019; Njoku 2014, Noh 2018, Vanek 2013, Wang 2014, Wang 2015, Wang 2017, Yang 2015, Zhang 2016, Qi 2013, Scholz 2011, Shen 2018, Shi 2016, Shi 2016, Yang 2016	*Not reported*
C5 palsy	*Not reported*	0% - 19% Source: Takase 2020
Enlargement of existing osteophyte	2.9% Source: Shi 2016	*Not reported*
Horner syndrome	0.02% - 4.04% Source: Lubelski 2020	*Not reported*
Leak of cerebrospinal fluid	1.5% - 4.3% Source: Qi 2013, Shi 2016b, Zhang 2016	*Not reported*
Non-union causing persistent left arm pain	2.4% Source: Njoku 2014	*Not reported*
Recurrent laryngeal nerve	*Not reported*	1% - 11% Source: Johnson 2020
Pseudarthrosis	Observed but no rate reported	Observed but no rate reported
Superficial wound infection	1.3% - 4.3% Source: Azab 2012, Fransen 2019, Zhang 2016	*Not reported*
Subsidence	1.5% - 8.6% Source: Lee 2015, Noh 2018, Njoku 2014, Shen 2018, Shi 2016	21% Source: Noordhoek
Surgical site hematoma	1.2% Source: Barbagallo 2013	*Not reported*
Transient hoarseness	1.3% - 11.1% Source: Azab 2012, Njoku 2014, Zhang 2016	*Not reported*

C. WARNINGS AND PRECAUTIONS

PREOPERATIVE

- The surgeon must be aware of not only the medical and surgical aspects of the implant, but also of the material limitations of titanium implants. The patient must be instructed in the limitations of the implant, especially with regard to the weight bearing and other body stresses on the device before a solid fusion occurs. The patient must be instructed that non-compliance with postoperative instructions could lead to failure of the device. The patient must be instructed that device failure could lead to the need for additional surgery to remove failed components.
- **Only patients that meet the criteria described in the indications should be selected and patients corresponding to the aforementioned contra-indications should not be selected.**

The following factors may be of importance when selecting patients for internal stabilization devices:

- foreign body sensitivity;
- certain degenerative diseases;
- senility, unable to understand/unwilling to follow physician's instructions, alcoholism, or drug abuse;
- obesity;
- patient's occupation or activity level;
- smoking.

- Additional sterile components should be available in case of any unexpected need**.**

INTRAOPERATIVE (Please see surgical technique GAC2-ST, latest applicable version at SPINEVISION SAS)

- Correct handling of the implants is extremely important. The implants must be transported in a way not to incur any damage. The implants must not be scratched and must not collide during handling.
- Care must be taken when picking up the Hexanium® ACIF implants, filling it with bone graft and inserting it between the vertebral bodies. Alterations may produce defects in surface finish and may become the focal point for eventual breakage of the implant or for decreased efficacy in withstanding post-operative migration (e.g. when teeth of implant are damaged).
- Correct selection of the implant size is extremely important. The chance of adequate stabilization is increased by the selection of the proper size of the implant regarding the anatomy and conditions of the patient. Proper selection of the implant can minimize, but not eliminate risks.
- The Hexanium® ACIF components have been designed for use with this system. Do not use the Hexanium® ACIF with any components not specifically recommended, or with any components from another manufacturer.
- The Hexanium® ACIF cannot be inserted via a posterior approach.
- The Hexanium® ACIF cannot be used in thoracic and lumbar spine.
- The implant should be placed on the peripheral cortical bone of the endplates to minimize the risk of post-operative subsidence.
- Surgical implants must never be reused. An explanted implant should never be reimplanted. Even though a device appears undamaged, it may have small defects and internal stress patterns that may lead to early breakage.

POSTOPERATIVE

- Careful patient monitoring for the first two to four months following the operation is very important while the fusion mass matures and becomes able to share load with the implant. Adequately instruct the patient in the appropriate postoperative care. The patient must be instructed to reduce stress on the implants in order to avoid clinical problems that may accompany failed fixation. The patient's ability and willingness to follow instructions are one of the most important aspects of successful bone healing. The patient must be instructed in the limitations of the implant, and that physical activity and full weight bearing may cause premature failure of internal stabilization devices by migrating, loosening or fracture. The patient must be instructed that an implant does not have the strength of normal healthy bone, and that device failure may occur if excessive loading is placed on the implant. An active, debilitated, or demented patient who is unable to use orthotic weight bearing devices may be particularly at risk.
- No internal stabilization device can withstand activity levels equal to those withstood by normal healthy segment. No implant can be expected to withstand unsupported weight-bearing stress indefinitely.

- Implants may fail when subjected to the increased loading associated with delayed union or non-union. Internal stabilization devices are intended as load-sharing devices until normal healing occurs. If normal healing does not occur or is delayed, the device may break due to fatigue. Patients should be informed of the risks of implant failure**.**

D. SUMMARY OF ANY FIELD SAFETY CORRECTIVE ACTION (FSCA)

Since the device is on the market, an FSCA has been established for Hexanium® ACIF in 2021 (Table 4).

Table 4 : FCSA list for the Hexanium® ACIF since its CE marking

DATE	REFERENCE	FSCA TYPE	DESCRIPTION
23/11/2021	R2111654 (ANSM reference)	Recall	There was no proven incident. This action was taken following an improvement proposed by SPINEVISION in order to better appreciate the end of travel of the screw when the surgeon places it in the Hexanium® ACIF cage.

This action has been taken by SPINEVISION SAS to make sure that the old versions of Hexanium® ACIF are no longer on the market and leave only the new versions. The safety and performance of the device are not compromised.

5. SUMMARY OF CLINICAL EVALUATION AND POST-MARKET CLINICAL FOLLOW-UP

A. CLINICAL BACKGROUND OF THE DEVICE

The Hexanium® ACIF system is on the market since 2019 with 4665 units sold worldwide up to 2022. The device is not considered as a new technology. Indeed, this technology (interbody cages for spinal fusion) has been used for several years in the medical field with proven safety and efficacy.

B. CLINICAL EVIDENCE FOR THE CE-MARKING

Since the device is on the market, SPINEVISION SAS has organized a non-interventional clinical study (observational study with only patient's data collection) to confirm the device's safety and performance for patients suffering from Degenerative Disc Disease (DDD).

A total of 144 patients, with 187 impaired disc levels have been treated by the Hexamium® ACIF. Among these patients, to this date, 27 adverse events have been registered in the study database which were related to 22 patients (15.3%). Four of these events (2.8%) were considered as serious (SAE) with two of them as having causal relationship to the index procedure (i.e., 2 patients with hematoma) and two possibly/probably related to the index procedure (i.e., cervicalgia and medullary hypersignal). Another event, categorized as non-serious, was considered as a causal effect of the index procedure (i.e., intermittent pain due to movement of the redon drain on the skin). All reported events happened between 0 and 735 days.

Preliminary results for the primary performance endpoint show improvement of the Neck Disability Index (NDI) score at 12-month post-procedure with a difference of 15.14% (n=47) compared to the baseline. Improvement of the NDI score was already observed at 2 months and 6 months post-procedure with mean difference of 14.04±20.96 (n=123) and 16.75±18.98 (n=90), respectively. Only three patients had their NDI score evaluated at 24 months and results still show improvement with a mean difference of 25.00±16.09 (n=3). The reduction of neck and arm pain was also assessed in patients. Pain reduction can be observed during all time points after the index procedure.

Medical imaging (i.e., X-Ray, CT-scan, MRI) was performed to assess fusion rate and system stability. Preliminary results show that at 2 months, fusion was already initiated in 93 patients (81.6%) including total fusion in 9 patients (7.7%) (data available for 117 patients); at 6 months, fusion was partial in 52 patients (71.2%) and total in 21 patients (28.8%; data available for 73 patients); at 12 months fusion

was partial in 14 patient (34.1%) and total in 27 patients (65.9%; data available for 41 patients). Finally, all seven patients evaluated at 24 months had total fusion (100%).

Additionally, system stability was assessed as stable for all patients evaluated during all follow-up visits except one patient at 12 months.

Finally, patient satisfaction was assessed based on 5-grade scale and revealed that more than 75% of patients were either very satisfied or somewhat satisfied with their surgery at every time point.

These preliminary results showed promising data that tend to confirm the clinical safety and performance claimed for Hexanium® ACIF.

C. SAFETY

Through preliminary analysis of the clinical study, patients treated by the Hexanium® ACIF system felt that their neck and arm pains were reduced even up to 24 months after the index procedure compared to prior they have been implanted with the device. Additionally, their disability was improved as reported during follow-ups (at 2-, 6-, 12- and 24-month post-procedure) compared to baseline. These preliminary results showed that implantation of Hexanium® ACIF improves patients' quality of life with limited risks. Through these preliminary results, SPINEVISION SAS considers that the benefit/risk ratio of using Hexanium® ACIF in patients with degenerative disc disease is positive.

Patients' inclusion is completed, but patients' clinical follow-ups are still ongoing. In the study set up in Europe, patients' inclusion and follow-ups are still ongoing.

Continuous collection of the data provided by the clinical study will allow to confirm the continuous safety and performance of Hexanium® ACIF.

6. POSSIBLE DIAGNOSTIC OR THERAPEUTIC ALTERNATIVES

When considering alternative treatments, it is recommended to contact your healthcare professional who can take into account your individual situation.

Theoretically, some treatment goals can be reached by conservative (nonsurgical) methods and they are generally the first choice for treatment. Conservative treatment options include:

- Medicines: Non-steroidal anti-inflammatory drugs (NSAIDs) and acetaminophen, anti-depressants, anti-epileptics, capsaicin, creams and ointments, lidocaine patches, colchicine, systemic corticosteroids, skeletal muscle relaxants, opioids
- Physical therapy and exercise
- Manipulation/ chiropractics
- Epidural steroid injections
- Ancillary treatments such as bracing, traction, electrical stimulation, acupuncture, and transcutaneous electrical stimulation.

As an alternative to the anterior approach for cervical fusion, the posterior approach can also be performed. Posterior Percutaneous Full-Endoscopic Keyhole cervical Foraminotomy (PPEKF) was developed as an alternative to the conventional posterior cervical fusion approach to avoid complications caused by open surgery.

Cervical Disc Arthroplasty (CDA) or Total Disc Replacement (TDR) was developed as an alternative procedure to preserve segmental motion and theoretically prevent adjacent segment degeneration. The theoretical advantages of CDA include: preservation of the motion patterns and the Range of Motion (ROM), reconstitution of disc height and spinal alignment, and earlier recovery of cervical function. However, in cases of multilevel cervical spondylosis and disc diseases, the affected discs may show different types and degrees of degeneration at each level.

Recently in the literature, the hybrid surgery that combines CDA with fusion has emerged as an effective alternative intervention for the treatment of multilevel cervical spondylosis to preserve cervical range of motion and reduce the risk of adjacent disc degeneration.

Transcorporeal tunnel approach is a relatively new alternative to ACDF that aim to remove part of a cervical vertebral body preserving the intervertebral disk to achieve cervical decompression. According to the literature, this approach seems to be a safe and efficient option for the treatment of cervical radiculopathy and myelopathy, but being a relatively new technique, further controlled studies are required to confirm the results.

7. SUGGESTED TRAINING FOR USERS

The Hexanium® ACIF can be implanted only by a trained orthopedic surgeon or neurosurgeon familiar with spine surgery as well as with the operating techniques relating to these implants.