May 24, 2024

Cook Biotech Incorporated
Christopher Lotzow
Manager, Regulatory Sciences
1425 Innovation Place
West Lafayette, Indiana 47906

Re: K232646
Trade/Device Name: Biodesign Otologic Butterfly Graft
Regulation Number: 21 CFR 874.3620
Regulation Name: Ear, Nose, And Throat Synthetic Polymer Material
Regulatory Class: Class II
Product Code: KHJ
Dated: April 24, 2024
Received: April 26, 2024

Dear Christopher Lotzow:

We have reviewed your section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (the Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database available at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Additional information about changes that may require a new premarket notification are provided in the FDA guidance documents entitled "Deciding When to Submit a 510(k) for a Change to an Existing Device" (https://www.fda.gov/media/99812/download) and "Deciding When to Submit a 510(k) for a Software Change to an Existing Device" (https://www.fda.gov/media/99785/download).

Your device is also subject to, among other requirements, the Quality System (QS) regulation (21 CFR Part 820), which includes, but is not limited to, 21 CFR 820.30, Design controls; 21 CFR 820.90, Nonconforming product; and 21 CFR 820.100, Corrective and preventive action. Please note that regardless of whether a change requires premarket review, the QS regulation requires device manufacturers to review and approve changes to device design and production (21 CFR 820.30 and 21 CFR 820.70) and document changes and approvals in the device master record (21 CFR 820.181).

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801); medical device reporting (reporting of medical device-related adverse events) (21 CFR Part 803) for devices or postmarketing safety reporting (21 CFR Part 4, Subpart B) for combination products (see https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR Part 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR Parts 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance) and CDRH Learn (https://www.fda.gov/training-and-continuing-education/cdrh-learn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Shuchen Peng -S

Shu-Chen Peng, Ph.D.
Assistant Director
DHT1B: Division of Dental and ENT Devices
OHT1: Office of Ophthalmic, Anesthesia,
Respiratory, ENT and Dental Devices
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2023
See PRA Statement below.

Submission Number *(if known)*

K232646

Device Name

Biodesign Otologic Butterfly Graft

Indications for Use *(Describe)*

The Biodesign Otologic Butterfly Graft is intended for use as an implant material to aid in the natural healing process in myringloplasty and tympanoplasty procedures.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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510(k) Summary
Biodesign® Otologic Butterfly Graft

I. Submitter

Cook Biotech Incorporated
1425 Innovation Place
West Lafayette, IN 47906
Phone: (765) 497-3355
Contact Person: Chris Lotzow, JD, RAC, Manager; Regulatory Strategy Development
Date Prepared: May 23, 2024

II. Subject Device

Name of Device:	Biodesign® Otologic Butterfly Graft
Common or Usual Name:	Surgical Mesh
Classification Name:	Polymer, Ent Synthetic-Polyamide (mesh or foil material)
Product Code:	KHJ (21 CFR §874.3620)
Regulatory Class:	Class II

III. Predicate Device

Biodesign® Otologic Repair Graft (K161000, Cook Biotech Incorporated)

IV. Device Description

The Biodesign Otologic Butterfly Graft is a self-securing butterfly-style graft structure with the same underlay component as the predicate device, attached to an external stabilizing component with an absorbable knotted thread, all made from the same SIS (small intestinal submucosa) ECM material as that of the predicate device. This self-securing structure maintains the location and close tissue approximation of the underlay component across the tympanic membrane (TM) defect as an implant material to aid in the natural healing process in myringoplasty and tympanoplasty procedures.

Design Features Supporting Product Performance:

The Biodesign Otologic Butterfly Graft is designed to provide a self-securing device configuration for use in myringoplasty and tympanoplasty procedures. Biological tissue comprising the device is remodeled through cell-mediated processes into native tympanic membrane-like tissue after successful implantation.

The self-securing structure of the device is designed to provide a standardized physical configuration of the butterfly graft structure users are familiar with from the historical use of autologous tissue butterfly grafts which are traditionally crafted as part of the tympanoplasty and myringoplasty procedures. This device configuration is an addition to the existing line of single-component flat sheet SIS predicate devices offered by the manufacturer.

Material Origin, Composition, and Mechanism of Action

The Biodesign® Otologic Butterfly Graft is composed of a dry porous biomaterial of layered extracellular collagen matrix (ECM) derived from porcine small intestinal submucosa (SIS). The SIS that is the sole material of the device is obtained from porcine intestine using a process that retains the natural composition of matrix molecules such as collagen (Types I, III, IV, VI), glycosaminoglycans (hyaluronic acid, chondroitin sulfate A and B, heparin, and heparin sulfate), proteoglycans, and fibronectin. Once implanted, the natural composition of SIS allows for the patient's healing mechanisms to deposit cells and collagen during cellular and extracellular matrix metabolism.

Device Structure/Configuration

The device is comprised of three components, all made from SIS ECM material.

1. The inner circular underlay component, which rests against the medial side of the tympanic membrane performs the intended use of the device as an aid in the natural healing process.
2. The external cross-shaped securing/stabilizing component, which rests against the outer/lateral face of the tympanic membrane and secures the underlay component in place after implantation.
3. A knotted SIS ECM thread joining the inner and outer structural components into the final device assembly.

This self-securing structure maintains the location and close tissue approximation of the underlay component across the tympanic membrane defect.

Implantation

The Instructions for Use (IFU) document supplied with the device gives a description of the implantation technique used in pre-clinical studies in animal and benchtop models following a trans-canal approach. This description involves the device being placed over the tympanic membrane defect with each quadrant of the underlay component then being pushed through the defect.

The process of pushing the underlay quadrants through the TM defect is able to be accomplished using standard otologic instruments. The device is configured in a way that each underlay quadrant is accessed through one of the recessed "circular wedge" gap areas in the cross-shaped outer securing component. In pre-clinical studies in animal and benchtop models, the described implantation technique resulted in a completed implantation where the inner and outer components are on opposite faces of the tympanic membrane, secured in place and to each other by the SIS thread through the defect.

During the natural healing process, the SIS thread is released as cellular activity within the underlay component progresses, releasing the external securing component and thread knot. Once released, the underlay component is the only part of the device remaining implanted in the patient and aiding the natural healing process, the same as the predicate device.

Product Sizes and Market Presentation

The Biodesign® Otologic Butterfly Graft is available with three underlay component size options of 0.4 cm, 0.6 cm, and 0.9 cm, each with proportionately sized outer securing components. For user convenience, the devices are provided in two sets pairing the 0.4 cm and 0.6 cm sizes in one part number, and the 0.6 cm and 0.9 cm sizes in another. The individual devices are delivered to the user in separate wells of a protective storage tray inside the sterile barrier pouch.

Indications for Use

The Biodesign Otologic Butterfly Graft is intended for use as an implant material to aid in the natural healing process in myringoplasty and tympanoplasty procedures.

The intended use of the subject device includes a technical change in the word content as compared to the K161000 predicate device, but only to the extent necessary to restrict the predicate's intended use statement to the subset of the originally cleared applications that are suitable for use with the subject device. The subject device is only intended for use in myringoplasty and tympanoplasty procedures where it is implanted as a self-securing assembly on both sides of the tympanic membrane through an open defect. Therefore, the parts of the intended use statement of the predicate that described use of the device in generalized "surgical repairs" and "various otologic procedures" have been removed and the appropriate grammatical updates have been made to the intended use statement to communicate the use of the subject device as limited to tympanoplasty and myringoplasty procedures.

These differences do not represent a change to the therapeutic or surgical use of the subject device compared to the predicate device in this subset of applications, and therefore the differences in the intended use statement do not constitute a new intended use of the device and do not affect the safety and effectiveness of the device when used as labeled.

V. Comparison of Technological Characteristics with the Predicate Device

The technological mechanism of action of the subject device is the same as that of the predicate device in relation to accomplishing the intended use of the device with the same device materials, chemical composition, principle of physiological action, and other aspects as included in the comparison table below.

The only differences present in the subject device are purely mechanical differences that relate to two aspects of the Principle of Operation of the device; the physical configuration of the multi-component device assembly, and the structural stiffness of the SIS device material resulting from use of the vacuum-press drying method.

Specifically, the differences between the devices are limited to:

1. The addition of an external stabilizing member with a connecting thread to the single flat sheet component of the predicate device to create a self-securing assembly that rests against the outer/distal tympanic membrane surface and secures the underlay component against the medial tympanic membrane surface.
2. Use of the Vacuum-Press drying method to provide structural stiffness to the SIS of the underlay and external stabilizing components.

Neither the mechanical assemblage of multiple SIS components, nor the vacuum-press drying method, introduce any differences to the predicate's established remodeling performance characteristics of the SIS material that is the sole medium for accomplishing the technological mode of action, as shown in the data submitted in support of the SE determination.

Relevance of the Design Differences to the Substantial Equivalence Evaluation

Fundamentally, the design differences present in the subject device are ancillary to the technological mechanism of action that accomplishes the intended use of providing a material to aid in the natural healing process. The design differences are solely intended to accomplish the goal of physically locating and securing the underlay component material against the medial surface of the tympanic membrane defect in a single device configuration. The design differences are limited to the device being a multi-component assembly configuration, and the use of vacuum-press dried SIS material for structural rigidity.

The following table presents the attributes of the subject device as compared to the predicate device in support of the categorization of the information submitted to establish the Substantial Equivalence of the subject device to the predicate device.

Substantial Equivalence Comparison table

attributes identical to the predicate are indicated as such in the first column

Device Attribute (comparison to predicate)	**Biodesign Otologic Butterfly Graft**	**Biodesign Otologic Repair Graft (Predicate)**
Manufacturer (same as predicate)	Cook Biotech Incorporated	Cook Biotech Incorporated
Product Code (same as predicate)	KHJ	KHJ
510(K) number	K232646	K161000

Intended Use (same but limited subset of the predicate)	The Biodesign Otologic Butterfly Graft is intended for use as an implant material to aid in the natural healing process in myringoplasty and tympanoplasty procedures	The Cook Biodesign Otologic Repair Graft is intended for use as an implant material to aid in surgical repairs and as an adjunct to aid in the natural healing process in various otologic procedures, including but not limited to myringoplasty and tympanoplasty.
Tissue Sourcing and Traceability Procedures (same as predicate)	Quality management system compliant with ISO 14971/ISO 13485	Quality management system compliant with ISO 14971/ISO 13485
Material (same as predicate)	Porcine SIS	Porcine SIS
Technological Mechanism of Action (same as predicate)	ECM provides scaffold for natural cell infiltration/proliferation leading to site-appropriate tissue remodeling	ECM provides scaffold for natural cell infiltration/proliferation leading to site-appropriate tissue remodeling
Principle of Operation	ECM underlay component secured to the medial tympanic membrane surface by the external self-securing overlay component	ECM underlay material secured to the medial tympanic membrane surface by packing in the middle ear
Physical configuration (design change #1)	Circular underlay component joined with a knotted SIS thread to a cross-shaped external self-securing overlay component	Single component circular or rectangular flat sheet material
SIS drying method (design change #2)	Vacuum Press	Lyophilization
Procedural approach/technique	The new implantation technique used in the supporting preclinical studies using animal and benchtop models following a trans-canal approach is evaluated for use with this device as a result of the design changes	None specified – device is adaptable to any procedural approach or implantation method selected by the user as appropriate for the indicated applications
Dimensions of underlay repair component (same but limited subset of the predicate)	Circular disks: 0.4 cm diameter 0.6 cm diameter 0.9 cm diameter	Circular disks: 0.4 cm diameter 0.6 cm diameter 0.9 cm diameter -and- Rectangular sheets: 2.5 cm x 2.5 cm 5 cm x 5 cm
Shelf life	6 months	18 months

Sterile Barrier Packaging (same as predicate)	Tyvek/PET pouch	Tyvek/PET pouch
Packaging configuration (same as predicate)	Labeled product box containing Tyvek sterile barrier pouch with inner protective tray containing paired device sizes	Labeled product box containing Tyvek sterile barrier pouch with inner protective tray containing paired device sizes
Sterilization method (same as predicate)	Ethylene Oxide (EO)	Ethylene Oxide (EO)
Sterilization level (same as predicate)	SAL: 10^{-6}	SAL: 10^{-6}

As detailed above, the differences from the predicate device are purely mechanical in nature, and do not involve the underlying technology or mechanism of action of the device as it accomplishes the intended purpose of performing as a material to aid in the natural healing process. The evidence described below establishes the Substantial Equivalence of the subject device to the predicate K161000 device by showing that the subject device is as safe, as effective, and performs as well as or better than, the predicate device by addressing:

- Safety (mechanical safety during implantation and throughout healing process):
    - The submitted data shows that the multi-component device structure is safe to the patient during implantation and during the patient's natural healing process.
- Effectiveness (physiological response as a material that aids the healing process):
    - The submitted data shows that the physiological response to the device's SIS material which accomplishes the intended use of being a material to aid in the natural healing process is not impacted by being part of multi-component mechanical structure or the vacuum-press drying method, as compared to the predicate device.
- Performance (mechanically locates and secures the material in an underly application):
    - The submitted data shows that the mechanical structure and configuration of the device function as intended during implantation and throughout the patient's natural healing process to locate and secure the underlay component of the device on the medial TM surface.

VI. Data supporting Substantial Equivalence

The following data were provided or referenced in support of the Substantial Equivalence determination.

Biocompatibility testing (re: safety)

Biocompatibility of the predicate device has been established in accordance with the ISO 10993 *Biological Evaluation of Medical Devices* series of standards. Biocompatibility test data for the subject device has been submitted in support of the substantial equivalence also under the ISO 10993 regime, specifically addressing:

- Part 1: *Evaluation and testing within a risk management process*
- Part 3: *Tests for genotoxicity, carcinogenicity, and reproductive toxicity*
- Part 5: *Tests for in vitro cytotoxicity*
- Part 6: *Tests for local effects after implantation*
- Part 7: *Ethylene oxide sterilization residuals*
- Part 9: *Framework for ident. and quant. of potential degradation products*
- Part 10: *Tests for skin sensitization*
- Part 11: *Tests for systemic toxicity*
- Part 18: *Chemical characterization of materials*
- Part 23: *Tests for Irritation*

Performance testing

Non-clinical performance testing – Bench (re: safety and performance):

Product verification testing was performed on SHS conditioned sterilized finished devices to evaluate the mechanical performance of the subject device for its intended use. Testing was leveraged from the predicate device for multiple endpoints common to both devices. Verification and Validation testing specific to the design features of this device included at least:

- burst strength,
- joint strength
- visual inspection at both t=0 and at the end of the established shelf life.

Non-clinical performance testing - Summative Usability Report (re: safety and performance)

The overall usability of the subject device was evaluated in a Summative Usability Report which utilized simulated-use testing to assess the performance of the subject device's handling and implantation in a worst-case benchtop model using the implantation technique described in the IFU. Data from the GLP animal study related to usability or benchtop models were included in the summative usability study to verify the device handling and usability characteristics in a hydrated state in an animal test model.

Non-clinical performance testing – animal study (re: safety, effectiveness, and performance):

The overall in-vivo performance of the subject device was evaluated in a chronic chinchilla tympanic membrane perforation model Animal Study. GLP animal data related to usability was used to verify the device handling and usability characteristics in a hydrated state. The acceptance criteria for the GLP Animal Study were that treated tympanic membranes must (1) appear visually healed, with no perforation observed via endoscopy at follow-up; (2) have a waveform on the tympanogram above the baseline perforated TM (i.e. Type A graph shape); and (3) histologically show healing in progress at follow-up, as determined by the Veterinary Pathologist's review of the histologic sections of the grafted/implanted tympanic membranes.

Equivalence comparison of subject device animal study performance data to the clinical and non-clinical data presented in support of clearance of the predicate K161000 device:

Clinical and animal model data was provided in the predicate submissions (K161000 and K150594) to support the safe and effective use of those devices for the corresponding intended use. Substantial Equivalence of the non-clinical animal study performance data of the subject device to the clinical and animal study performance data provided in the predicate 510k submissions is supported through equivalence in:

- Healing/closure rates,
- Study endpoints and evaluation method,
- Histologic assessment, and
- Number of SIS-implanted TM perforations

The animal study submitted in support of clearance of the subject device showed a healing/closure rate of 79% among the 14 tympanic membrane perforations implanted with the subject device (11/14). This healing/closure rate is within the range of the clinical and animal data submitted in support of the predicate device (63-100%). The animal study for the subject device evaluated the status of TM closure through a functional tympanogram technique. Histological evaluation of the healed TM tissue showed a tri-laminar healed TM structure in the animal studies for both the predicate and subject device. Additionally, the number of TM perforations implanted with SIS in the animal study for the subject device exceeds that of the predicate's animal study and is similar to most of the clinical study data cited to support the predicate device. Therefore, the animal study performance data submitted in support of the subject device is Substantially Equivalent to the clinical and animal study data of the predicate device.

Packaging system and shelf-life testing (re: safety):

Non-clinical bench testing was performed on accelerated-aged representative SHS conditioned packaging system samples to confirm that the packaging system is adequate to support a 6-month shelf-life claim. Testing at additional timepoints is ongoing and the product shelf life will be extended as stability, package system integrity, and product performance testing data justifies.

Sterilization (re: safety):

The subject Biodesign® Otologic Butterfly Graft device undergoes the ethylene oxide (EO) sterilization process, with the sterile barrier established at the secondary packaging pouch level which holds the protective tray containing a paired set of devices. A sterilization adoption analysis was performed per AAMI TIR28:2016 with respect to the predicate device.

VII. Conclusion

Substantial Equivalence Conclusion:

For purposes of determinations of substantial equivalence under *section 513(i) of the FD&C Act (21 U.S.C. § 360c(i))*, the Biodesign® Otologic Butterfly Graft device has the same but restricted intended use and functions to accomplish the intended use under the same mode of action as the predicate device. The three main differences presented to the user and patient through use of the subject device are the multi-component physical device structure, the material stiffness achieved from the vacuum-press drying method, and the implantation technique described in the IFU. The physical, functional, biocompatibility, and performance characteristics of the subject device are substantially equivalent to the predicate device and do not indicate any new or increased risks to safety or effectiveness when used according to its labeling.

Therefore, the submitted verification and validation testing addressing performance, packaging, and animal study supports the Substantial Equivalence of the Biodesign® Otologic Butterfly Graft to the legally marketed predicate K161000 device.