Aroa Biosurgery Ltd.
Dr. Isabela Monteiro
Regulatory Specialist
2 Kingsford Smith Place
Airport Oaks
Auckland, 2022
NEW ZEALAND

January 23, 2024

Re: K231305
Trade/Device Name: Endoform Dental Membrane
Regulation Number: 21 CFR 872.3930
Regulation Name: Bone Grafting Material
Regulatory Class: Class II
Product Code: NPL, NPM
Dated: August 24, 2023
Received: December 22, 2023

Dear Dr. Isabela Monteiro:

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,

Sherrill Lathrop Blitzer

for Andrew Steen
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: 07/31/2026
See PRA Statement below.

Submission Number *(if known)*

K231305

Device Name

Endoform Dental Membrane

Indications for Use *(Describe)*

Endoform Dental Membrane is specifically intended for use in extraction sockets and soft tissue grafting. The device contains and prevents migration of guided bone regeneration graft material and prevents loss of alveolar height and ridge following tooth extraction. The device is provided sterile and intended for one-time use.

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.

510(k) #: K231305

510(k) Summary

Prepared on: 2024-01-23

Contact Details

21 CFR 807.92(a)(1)

Applicant Name	Aroa Biosurgey Ltd.
Applicant Address	2 Kingsford Smith Place Airport Oaks Auckland 2022 New Zealand
Applicant Contact Telephone	+64 22 1829255
Applicant Contact	Dr. Isabela Monteiro
Applicant Contact Email	isabela.monteiro@aroa.com

Device Name

21 CFR 807.92(a)(2)

Device Trade Name	Endoform Dental Membrane
Common Name	Bone grafting material
Classification Name	Barrier, Animal Source, Intraoral
Regulation Number	872.3930
Product Code(s)	NPL

Legally Marketed Predicate Devices

21 CFR 807.92(a)(3)

Predicate #	Predicate Trade Name (Primary Predicate is listed first)	Product Code
K082058	DynaMatrix™	NPL
K192042	BIO-GIDE	NPM
K092096	Endoform Dermal Template	KGN
K130547/ K153633	Endoform Reconstructive Template	FTM
K153632/ K181935	Endoform Reconstructive Template	FTL

Device Description Summary

21 CFR 807.92(a)(4)

Endoform Dental Membrane is an ovine derived bioabsorbable extracellular matrix intended for application in dental and periodontal procedures. The device is composed of non-cross linked and non-reconstituted collagen. The device is supplied sterile in a variety of sizes and thicknesses which may be trimmed by a licensed dentist or oral surgeon to meet individual patient needs.

Intended Use/Indications for Use

21 CFR 807.92(a)(5)

Endoform Dental Membrane is specifically intended for use in extraction sockets and soft tissue grafting. The device contains and prevents migration of guided bone regeneration graft material and prevents loss of alveolar height and ridge following tooth extraction. The device is provided sterile and intended for one-time use.

Indications for Use Comparison

21 CFR 807.92(a)(5)

Endoform Dental Membrane is indicated for a sub-set of those cleared for the predicate, DynaMatrix - specifically to contain and prevent

migration of guided bone regeneration graft material and prevent loss of alveolar height and ridge following tooth extraction. The narrower indications scope does not introduce any new or different questions of safety or effectiveness.

Technological Comparison 21 CFR 807.92(a)(6)

The primary technological difference between the subject and predicate devices is the source animal tissue. Endoform Dental Membrane is derived from ovine forestomach, while DynaMatrix is derived from porcine small intestine (SIS). Both devices are collagen-based extracellular matrices derived from mammalian sources, thus are subject to animal risk management and controls defined in ISO 22442 series as well as FDA Special Controls.

There are minor differences in the sizes and thickness of the subject device and predicate device, but these minor differences do not raise any new or different safety concerns.

Bio-Gide (K192042) has been included as a reference device in order to support in vivo performance testing of the subject device. Endoform Dermal Template (EDT, K092096) and Endoform Reconstructive Template (ERT, K130547/ K153633/K153632/ K181935) have been included as reference devices in order to support the safety of ovine-derived extracellular matrix.

Non-Clinical and/or Clinical Tests Summary & Conclusions 21 CFR 807.92(b)

Aroa has conducted the following non-clinical testing on Endoform Dental Membrane (EDM):
1. Collagen Content
Quantification of total collagen in EDM devices was assessed according to a validated test method where collagen is measured via hydroxyproline content using a commercially available assay kit (Chondrex Inc, USA). The test method is based on the established procedures described by Blumenkrantz and Asboe-Hanson, 1973. Total collagen in mass percentage was verified to be above 70%.

2. GAG Content
Quantification of GAGs in EDM devices proceeded according to a validated test method where GAGs are measured using a commercially available assay kit (Biocolor Ltd, UK). The test method is based on the assay described by Freytes et al, 2008. Results showed that the subject device meets the minimum GAG content specification.

3. DNA Content
DNA quantification was conducted using a validated quantitative fluorometric assay based on the method described by Kim et al, 1988, where binding of a fluorescent dye (Hoechst 33258) allows quantification of double stranded DNA in test samples. All EDM devices met the pre-defined DNA contentment specification.

4. Fibronectin and Laminin presence
Fibronectin and laminin are structural proteins that form part of the collagen matrix and basement membrane and remains bound to the collagen matrix after tissue processing and terminal sterilization. The presence of fibronectin and laminin in tissues used to manufacture EDM devices was determined by a validated immunohistochemistry (IHC) procedure and confirmed the presence of both proteins in all EDM devices.

5. Moisture Content
Quantification of moisture (water) content according to the standard test method AOAC 984.20 Moisture in Oils and Fats, Karl Fischer Method showed that the subject device meets the stipulated moisture content.

6. Differential Scanning Calorimetry (DSC)
Differential Scanning Calorimetry was used to determine collagen structure stability via determination of the melting point onset temperature as described by Sun and Leung, 2008. Changes in tissue processing methods may stabilize or destabilize the collagen structure and, therefore, increase or decrease the melting point onset temperature. The pre-defined melting point onset temperature specification was met for all EDM devices.

7. Rehydration Time
EDM devices are presented dry and require rehydration prior to application. As part of design verification activities, the rehydration rate of devices was quantified using a validated test method and demonstrated that the subject device can be rehydrated in less than 5 minutes.

8. Tx-100, EDTA and PAA Residuals
Allowable limits of Tx-100, ethylenediamine tetraacetic acid (EDTA), and peracetic acid (PAA) in EDM devices have been established according to the methodology of ISO 10993-17, Biological evaluation of medical devices – Part 17: Establishment of allowable limits for leachable substances. Tx-100 concentrations in EDM devices were measured using a validated procedure according to the methodology described by Crabb and Persinger, 1964, EDTA was measured using commercially available EDTA test strips (Merck Inc, USA), and PAA measured using PAA quantification test strips (J-Quant, England). Tx-100, EDTA, and PAA residuals were found to be below the predetermined specifications. PAA residue content is monitored and 100% verified on every production batch.

9. Bioburden
Bioburden testing was conducted according to ISO 11737-1, performed in on pre-sterilization devices. Results demonstrated that the subject device meets the specification for bioburden of <1000 CFU/device.

10. Endotoxin
As part of design verification and lot release testing, EDM devices are tested for the presence of endotoxins (<20 EU/device) via a validated Kinetic-QCL™ Limulus Amebocyte Lysate (LAL) assay (Lonza, Switzerland).

11. Permeability
Permeability testing was used to determine the rate that water can flow through EDM devices using a validated hydrostatic permeability test method (Freytes, Tullius et. al. 2006) where the Permeability Index is calculated according to established procedures. The subject device was found to be permeable to aqueous solutions (PI>0).

12. Suture Retention Strength
Suture retention strength testing is used to determine the anastomotic strength of a material by placing a suture loop through the material and applying force to the suture loop to determine the resistance of the material to suture pull-out. This test is performed by using a universal testing system (UTS) with a clamp to hold the sample and a hook to secure the suture loop. The maximum amount of force (suture retention) required to pull out the sure loop is determined. This testing method is defined in ANSI/AAMI VP20-1994 "Section 5.8 – Suture Retention Strength". EDM devices were tested for suture retention and found to meet the defined specification of = 1.5 N.

13. Modulus of Elasticity
Modulus of elasticity of EDM devices was determined from uniaxial testing to a validated procedure in accordance with ASTM D882-18, Tensile Properties of Thin Plastic Sheeting and ASTM D638-14, Tensile Properties of Plastics. The test was performed by using a universal testing system with clamps attached to hold the sample. Test results demonstrate that the subject device meets the design specification of modulus of elasticity.

14. Thickness
Device thickness was measured using a validated test method and qualified thickness measuring equipment (Digital Thickness Gauge). The thickness of the samples was measured at five separate locations and the mean thickness was found to meet the specification for all EDM devices.

15. Sterilization
Endoform Dental Membrane devices are terminally sterilized to a sterility assurance level (SAL) of 10-6 using ethylene oxide (EO). The sterilization cycle was validated using a '½ cycle' (overkill) method in accordance with ISO 11135. All tested devices from three ½ cycles and one full cycle were 'sterile' when tested for sterility in accordance with ISO 11737-2. Devices from the sterilization validation were tested for residuals (ethylene oxide and ethylene chlorohydrin) in accordance with ISO 10993-7 and found to present residuals below the specification limits.

16. Packaging
Endoform Dental Membrane devices are packaged in heat sealed Tyvek/film medical pouches. The packaging studies were conducted in parallel to the product stability studies, up to 36 months of real-time aging. Pouches were tested for dye penetration (as per ASTM F88/F88M-15), T-peel (as per ASTM F1929-15) and visual inspection, with all pouches meeting the pre-defined specifications.

17. Shelf Life
Endoform Dental Membrane devices were subjected to prolonged storage under controlled environments according to ISO 11607-1. The subject device was tested for biochemical composition (Endotoxin, GAG and DNA concentrations), moisture content, suture retention, DSC and visual inspection at multiple aging time points up to 36 months. All devices met the design specifications across all time points tested.

18. Biocompatibility Testing
The biocompatibility verification of Endoform Dental Membrane was conducted in compliance with ISO 10993 series standards. A list of the ISO 10993 biocompatibility endpoints assessed is provided below:
- Cytotoxicity
- Sensitization (Delayed type hypersensitivity)
- Irritation (Intracutaneous reactivity)
- Material Mediated Pyrogenicity
- Acute systemic toxicity
- Subacute toxicity
- Chronic toxicity
- Implantation
- Hemocompatibility

• Genotoxicity
• Carcinogenicity
• Reproductive and Developmental Toxicity
• Biodegradation/Degradation
• Toxicokinetics
• Immunotoxicity

The biocompatibility testing data demonstrates that the subject device is biocompatible in accordance with ISO 10993 standards.

19. Animal Performance Testing
The in vivo safety and performance of the Endoform Dental Membrane device with respect to healing and resorption time was compared to the performance of the reference device, Bio-Gide. The study undertaken in an ovine (sheep) defect model was conducted in compliance with applicable GLP (21 CFR Part 58) requirements. Defects were filled with Geistlich Bio-Oss® bovine bone xenograft and subsequently closed with either Endoform Dental Membrane or Bio-Gide®. Animals were euthanized and the tissues extracted at selected timepoints (week 4, 8 and 16). Endoform Dental Membrane was found to pass the following acceptance criteria:
• Resorption of the Endoform Dental Membrane is non-inferior to the reference collagen membrane (Bio-Gide)
• Cellular infiltration and inflammatory response of Endoform Dental Membrane is non-inferior to Bio-Gide
• Retention of bone grafting material and corresponding hard tissue infill of defects treated with Endoform Dental Membrane is non-inferior to that of Bio-Gide.
Additionally, the study demonstrated that the defects used in the in vivo model were critically sized as untreated controls did not completely regenerate bone. No adverse events occurred during execution of the protocol.

20. Clinical Performance Testing
Clinical data was not required to demonstrate substantial equivalence.

21. List of standards referenced
•ANSI ST72:2019, Bacterial endotoxins - Test methods routine monitoring and alternatives to batch testing
• 21 CFR 820.30, FDA Design Control Guidance for Medical Device Manufacturers
• ASTM D638-10, Standard Test Method for Tensile Properties of Plastics
• ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting
• ASTM F1929-15, Standard Test Method for Detecting Seal Leaks in Porous Medical Packaging by Dye Penetration
• ASTM F88/F88M-15, Standard Test Method for Seal Strength of Flexible Barrier Materials
• BS EN 868-5:1999, Packaging Materials and Systems for Medical Devices Which are to be Sterilized
• ISO 10993-1:2009, Biological Evaluation of Medical Devices - Part 1: Evaluation and Testing Within a Risk Management Process
• BS EN ISO 10993-3:2014, Biological Evaluation of Medical Devices - Part 3: Tests for Genotoxicity, Carcinogenicity and Reproductive Toxicity
• BS EN ISO 10993-5:2009, Biological Evaluation of Medical Devices - Part 5: Tests for in vitro Cytotoxicity
• BS EN ISO 10993-6:2016, Biological Evaluation of Medical Devices - Part 6: Tests for Local Effects After Implantation
• EN ISO 10993-7:2008 + AC 2009, Biological Evaluation of Medical Devices - Part 7: Ethylene Oxide Sterilization Residuals
• BS EN ISO 10993-10:2010, Biological Evaluation of Medical Devices - Part 10: Tests for Irritation and Skin Sensitization
• BS EN ISO 10993-11:2009, Biological Evaluation of Medical Devices - Part 11: Tests for Systemic Toxicity
• ISO 10993-12:2012, Biological Evaluation of Medical Devices - Part 12: Sample Preparation and Reference Materials
• ISO 10993-17:2002, Biological Evaluation of Medical Devices - Part 17: Establishment of Allowable Limits for Leachable Substances
• ISO 11135:2014, Sterilization of health-care products - Ethylene oxide - Requirements for the development validation and routine control of a sterilization process for medical devices
• ISO 11607-1:2019, Packaging for terminally sterilized medical devices - Part 1: Requirements for materials sterile barrier systems and packaging systems
• ISO 11607-2:2019, Packaging for terminally sterilized medical devices - Part 2: Validation requirements for forming sealing and assembly processes
• ISO 11737-1:2018, Sterilization of health care products - Microbiological methods - Part 1: Determination of a population of microorganisms on products - Third Edition + AMD 1: 2021
• ISO 11737-2:2018, Sterilization of medical devices - Microbiological methods - Part 2: Tests of sterility performed in the definition, validation and maintenance of a sterilization process - Second Edition
• ISO 14971:2019, Medical devices - Application of risk management to medical devices - Third edition
• ISO 15223-1:2021, Medical devices - Symbols to be used with information to be supplied by the manufacturer - Part 1: General requirements
• ISO 22442-1:2020, Medical devices utilizing animal tissues and their derivatives - Part 1: Application of risk management - Second Edition
• ISO 22442-2:2020, Medical devices utilizing animal tissues and their derivatives - Part 2: Controls on sourcing, collection and handling - Second Edition
• ISO 22442-3:2007, Medical devices utilizing animal tissues and their derivatives - Part 3: Validation of the elimination and/or inactivation of viruses and transmissible spongiform encephalopathy (TSE) agents - First Edition
• ISO 22442-4:2007, Medical Devices Utilizing Animal Tissues and Their Derivatives - Part 4: Principles for Elimination and/or Inactivation

of Transmissible Spongiform Encephalophathy (TSE) Agents and Validation Assays for those Processes.
• ISO 13485:2016, Medical devices - Quality management systems - Requirements for regulatory purposes - Third Edition

22.Conclusion
The indications for use, overall design, technological and performance characteristics of the subject and predicate devices are substantially equivalent. Based on the data and evidence presented from performance testing of Endoform Dental Membrane, Aroa concludes that the device is substantially equivalent to the legally marketed device and is safe and effective for its intended use. Differences between the proposed and predicate device do not raise any new issues of safety or effectiveness.