April 19, 2018

Boston Scientific Corporation
Heidi Shearer
Regulatory Affairs Specialist
3 Scimed Place
Maple Grove, MN 55311

Re: K180102
Trade/Device Name: Embozene Color-Advanced Microspheres
Regulation Number: 21 CFR§ 876.5550
Regulation Name: Prostate Artery Embolization Device
Regulatory Class: II
Product Code: NOY, KRD, NAJ
Dated: January 18, 2018
Received: January 19, 2018

Dear Heidi Shearer:

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 (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. 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.

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 803); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820); and if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm for the CDRH's Office of Surveillance and Biometrics/Division of Postmarket Surveillance.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/) and CDRH Learn (http://www.fda.gov/Training/CDRHLearn). 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 (http://www.fda.gov/DICE) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Charles Viviano -S

For Benjamin R. Fisher, Ph.D.
Director
Division of Reproductive, Gastro-Renal,
and Urological Devices
Office of Device Evaluation
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: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K180102

Device Name
Embozene Color-Advanced Microspheres

Indications for Use *(Describe)*
Embozene Microspheres are intended for embolization of arteriovenous malformations and hypervascular tumors, including uterine fibroids (UFE) and hepatoma, and for embolization of prostatic arteries (PAE) for symptomatic benign prostatic hyperplasia (BPH).

This device is not intended for neurovascular 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.

This section applies only to requirements of the Paperwork Reduction Act of 1995.

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510(k) Summary
per 21 CFR §807.92

Sponsor	Boston Scientific Corporation 300 Boston Scientific Way Marlborough, Massachusetts 01752 USA
Contact Name and Information	Heidi Shearer Three Scimed Place Maple Grove, MN 55311-1566 Phone:763-255-0056 Fax: 763-494-2222 e-mail: Heidi.Shearer@bsci.com
Prepared	12 January 2018
Proprietary Name	Embozene™ Color-Advanced Microspheres
Common Name	Prostatic Artery Embolization Device Vascular Embolization Device
Product Code	NOY KRD, NAJ
Classification	Class II, 21 CFR Part 876.5550 (NOY) and 21 CFR Part 870.3300 (KDR, NAJ)
Predicate Device	Embosphere® Microspheres (Embosphere PRO™ Prostatic Artery Embolization Kit), Merit Medical Systems Inc. DEN160040 (21-Jun-2017)
Reference Device	Embozene™ Color-Advanced Microspheres, Boston Scientific Corporation K141209 (07-Aug-2014)

Device Description

Embozene™ Color-Advanced Microspheres (hereafter referenced as Embozene or Embozene Microspheres) are spherical, tightly calibrated, biocompatible, non-resorbable, hydrogel microspheres coated with proprietary polymer (Polyzene®-F). The microspheres are compressible to enable smooth delivery through the indicated delivery catheter and color-coded by size to allow for easy identification.

Microspheres are supplied sterile and packaged in 20 ml syringes with an approximate 7ml fill volume across the range. Embozene microspheres syringes are available in 2 ml microsphere volume for 40 – 1300 µm.

Indications for Use/ Intended Use

Embozene Microspheres are intended for embolization of arteriovenous malformations and hypervascular tumors, including uterine fibroids (UFE) and hepatoma, and for embolization of prostatic arteries (PAE) for symptomatic benign prostatic hyperplasia (BPH).

This device is not intended for neurovascular use.

Comparison of Technological Characteristics

The Embozene Microspheres are substantially equivalent to the legally marketed Merit Medical Systems Inc. Embosphere® Microspheres, cleared by FDA (DEN160040), in regard to indications for use and similar in technological characteristics. Both devices are spherical, non-resorbable polymer microspheres which are delivered through a microcatheter to embolize the target vessel. There are differences in actual material composition; however, the materials of the Embozene Microspheres are well-known and widely used in the medical environment and are biocompatible for their intended use. The devices are available in similar sizes, Embozene (40-1300 µm) vs Embosphere (40-1200 µm). While Embozene is available in a slightly larger diameter, the size range typically used to treat the prostatic artery are the same between both devices. The differences in materials and size range of these devices do not affect overall safety or effectiveness as demonstrated by clinical data. The Embozene Microspheres are identical to the reference device, Boston Scientific's Embozene Microspheres (K141209), in design, function, device materials, packaging, sterilization method, operating principle, and fundamental technology.

Summary of Bench Tests

Non-clinical tests performed on the Embozene Microspheres, reference device, provide reasonable assurance that the proposed device has been designed and tested to assure conformance to the requirements for its intended use. A risk assessment was performed and demonstrates that the expanded indication did not require additional bench, biocompatibility, sterilization, or pre-clinical animal testing beyond what was required for the reference device. All existing testing provided in the previous Embozene Microspheres premarket submissions remains applicable.

Biocompatibility testing provided in the previous Embozene Microspheres premarket notification included: Cytotoxicity, Sensitization, Irritation, Sub-Acute and Sub-Chronic Systemic Toxicity, Systemic Toxicity- Material Mediated Pyrogenicity, Genotoxicity (Bacterial Mutagenicity, In-vitro Chromosome Aberration, In-Vivo Micronucleous Assay), Implantation, Hemocompatibility (hemolysis, partial thromboplastin time, platelet/leukocyte counts). All tests passed, indicating that the device materials are biocompatible for its intended use.

Performance testing provided in the previous Embozene Microspheres premarket notification included: Microsphere size distribution, visual inspection, pH of transport solution, Osmolality of transport solution, Microsphere suspension, Catheter compatibility, and Elution Test: Determination of leachable substances by UV-Vis, HPLC, and ICP-MS. All tests passed demonstrating the device meets the pre-determined performance requirements.

Published literature on four (4) preclinical animal studies assessed the biocompatibility, safety, and efficacy of Embozene Microspheres in comparison with the Embosphere predicate and other embolization devices. The devices were evaluated in a porcine kidney model to determine arterial distribution characteristics, inflammation and recanalization, impact on inflammatory tissue and foreign body reaction, and immunohistochemical inflammatory reactions. The results demonstrate a similar biological tissue response between the Embozene Microspheres and the Embosphere predicate device which supports substantial equivalence.

Additionally, for labeling with MR compatibility, the proposed Embozene Microspheres were assessed and met requirements in the Guidance for Industry and Food and Drug Administration Staff *Establishing Safety and Compatibility of Passive Implants in the Magnetic Resonance (MR) Environment*.

Clinical Data Summary

Clinical data from a prospective clinical study along with literature on the Embozene Microspheres supports the expanded indication for use and is considered to be substantially equivalent in safety and effectiveness to the predicate Merit Medical's Embosphere Microspheres.

A prospective clinical study at a single center evaluated 38 patients that underwent a prostatic artery embolization (PAE) using Embozene Microspheres for the treatment of symptomatic benign prostatic hyperplasia (BPH). The primary endpoints included safety and the symptomatic improvement of BPH symptoms through follow-up as measured by the International Prostate Symptom Score (IPSS) and the peak flow rate (Qmax). Safety was assessed from the reported adverse events. At baseline, patients underwent a clinical assessment for Qmax, post void residual (PVR), prostate volume (PV) and prostate specific antigen (PSA) levels. All patients also completed the validated symptom and quality of life (QoL) questionnaires. Clinical assessments included the validated IPSS, International Index of Erectile Function (IIEF) and quality of life (QOL) questionnaires.

Results

Thirty-eight male evaluable subjects have been enrolled in the study with a mean age of 64.6±8.4 years. Bilateral embolization procedures were performed in 94.7% (36/38). Post procedural radiographic evidence demonstrated that the embolization procedures were 100% (38/38) successful without any cases of non-targeted embolization. Table 1 summarizes the baseline characteristics.

Table 1 Baseline Data

Characteristic	Embozene Prospective Data Mean±SD (n)
Age Yrs	64.6±8.4 (38)
IPSS	21.2±6.7 (37)
Quality of Life	4.4±1.1 (38)
Qmax (ml/s)	10.9±6.9 (30)
Prostate Volume (ml)	79.0±55.7 (38)
PSA (ng/ml)	3.7±3.4 (38)

The average 6 month and 12 month IPSS scores demonstrated a symptomatic improvement over baseline at 46% and 47%, respectively. Additionally, 81.8% of the subjects improved at least 3 IPSS points at 12 months (Table 3). The baseline QoL score of 4.4 (mostly dissatisfied) improved to a 2.3 (mostly satisfied) at 3 months which was maintained through 12 months. A prostate volume reduction was also maintained through the follow up with an increase of the peak flow rates (Qmax).

Table 2 Mean Results for Baseline, 3 Months, 6 Months and 12 Months

Characteristic	Embozene Prospective Data			
	Baseline Mean±SD(n)	**3 months Mean±SD (n)**	**6 months Mean±SD (n)**	**12 months Mean±SD (n)**
IPSS	21.2±6.7 (37)	10.8±7.7 (36)	11.5±8.1 (37)	11.3±6.3 (23)
Quality of Life	4.4±1.1 (38)	2.3±1.2 (33)	2.1±1.3 (36)	2.3±1.4 (23)
Qmax (ml/s)	10.9±6.9 (30)	17.6±16.8 (12)	15.4±7.7 (23)	18.5±10.2 (10)
Prostate Volume (ml)	79.0±55.7 (38)	69.3±35.1 (7)	65.1±41.4 (33)	56.8±24.3 (5)

Table 3 Proportion of Patients with at least 1 and 3 point IPSS Improvement

IPSS Points	Embozene Prospective Data		
	3 months % (n/N) 95% CI	**6 months % (n/N) 95% CI**	**12 months % (n/N) 95% CI**
At least 1 point improvement	85.7% (30/35) [69.7%, 95.2%]	88.9% (32/36) [73.9%, 96.9%]	95.5% (21/22) [77.2%, 99.9%]
At least 3 points improvement	82.9% (29/35) [66.4%, 93.4%]	80.6% (29/36) [64.0%, 91.8%]	81.8% (18/22) [59.7%, 94.8%]

The adverse events are presented in Table 4 by system organ class (SOC) and Preferred Term (PT). There were no serious adverse events or device related events reported. The investigative site did not report any post-prostatic artery embolization syndrome events.

Table 4 Adverse Events by SOC and PT

System/Organ Class	Preferred Term	Total Events (Subjects)	Rate of Subjects with Event
Total	Total	22 (15)	39.5%
Renal and urinary disorders	Total	12 (9)	23.7%
	Hematuria	3 (3)	7.9%
	Dysuria	2 (2)	5.3%
	Micturition urgency	2 (2)	5.3%
	Urine flow decreased	2 (2)	5.3%
	Pollakiuria	1 (1)	2.6%
	Urinary incontinence	1 (1)	2.6%
	Urinary retention	1 (1)	2.6%
Infections and infestations	Total	3 (3)	7.9%
	Cystitis	2 (2)	5.3%
	Penile infection	1 (1)	2.6%
Nervous system disorders	Total	2 (2)	5.3%
	Paraesthesia	2 (2)	5.3%
Reproductive system and breast disorders	Total	2 (2)	5.3%
	Penis disorder	1 (1)	2.6%
	Spermatic cord pain	1 (1)	2.6%
Blood and lymphatic system disorders	Total	1 (1)	2.6%
	Leukocytosis	1 (1)	2.6%
Musculoskeletal and connective tissue disorders	Total	1 (1)	2.6%
	Muscle tightness	1 (1)	2.6%
Psychiatric disorders	Total	1 (1)	2.6%
	Sleep disorder	1 (1)	2.6%

Conclusion

Based on the indications for use, technological characteristics, safety and performance testing, and clinical evidence, the Embozene Color-Advanced Microspheres have been shown to support safety and effectiveness and are considered to be substantially equivalent to Embosphere Microspheres when indicated for embolization of prostatic arteries for symptomatic benign hyperplasia (BPH).

The Embozene Microspheres demonstrates compliance with the Special Controls under 21 CFR 876.5550 for the expanded indication for use and 21 CFR 870.3300.

In addition, the MR Compatability meets the requirements of the Guidance Document *Establishing Safety and Compatibility of Passive Implants in the Magnetic Resonance (MR) Environment*.