



July 12, 2024

Think Surgical, Inc.
Meliha Mulalic
Vice President, QA/RA
47201 Lakeview Blvd
Fremont, California 94538

Re: K241031

Trade/Device Name: TMINI Miniature Robotic System (TMINI 1.1)
Regulation Number: 21 CFR 882.4560
Regulation Name: Stereotaxic Instrument
Regulatory Class: Class II
Product Code: OLO
Dated: May 10, 2024
Received: May 13, 2024

Dear Meliha Mulalic:

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,


Shumaya Ali -S

Shumaya Ali, M.P.H.

Assistant Director

DHT6C: Division of Restorative, Repair
and Trauma Devices

OHT6: Office of Orthopedic Devices

Office of Product Evaluation and Quality

Center for Devices and Radiological Health

Enclosure

Indications for Use

510(k) Number (if known)

K241031

Device Name

TMINI™ Miniature Robotic System (TMINI 1.1)

Indications for Use (Describe)

TMINI™ Miniature Robotic System is indicated as a stereotaxic instrumentation system for total knee replacement (TKA) surgery. It is to assist the surgeon by providing software-defined spatial boundaries for orientation and reference information to identifiable anatomical structures for the accurate placement of knee implant components. The robotic device placement is performed relative to anatomical landmarks as recorded using the system intraoperatively and based on a surgical plan determined preoperatively using CT based surgical planning tools. It includes a handheld robotic device, an optical sensor navigation system and accessories, software system, surgical instruments and accessories.

The robotic device placement is performed relative to anatomical landmarks as recorded using the system intraoperatively and based on a surgical plan determined preoperatively using CT based surgical planning tools.

It includes a handheld robotic device, an optical sensor navigation system and accessories, software system, surgical instruments and accessories.

The targeted population has the same characteristics as the population that is suitable for the implant(s) compatible with the TMINI™ Miniature Robotic System. The TMINI™ Miniature Robotic System is to be used with the following knee replacement system(s) in accordance with the indications and contraindications:

- Enovis™ EMPOWR Knee System®
- Ortho Development® BKS® and BKS TriMax® Knee System
- Total Joint Orthopedics Klassic® Knee System
- United® U2™ Knee Total Knee System

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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TMINI™ Miniature Robotic System (TMINI 1.1) Traditional 510(k) Submission

510(k) SUMMARY

Applicant Information:

Owner Name:	THINK Surgical, Inc.
Address:	47201 Lakeview Blvd., Fremont, CA 94538
Phone number:	408-921-5648
Fax number:	510-249-2396
Establishment Registration Number:	3000719653
Contact Person:	Meliha Mulalic
Date Prepared:	15 April 2024

Device Information:

Device Classification:	Class II
Trade Name:	TMINI™ Miniature Robotic System
Common name:	Orthopedic Stereotaxic Instrument
Classification name:	Stereotaxic Instrument
Regulation number:	882.4560
Product Code:	OLO

Predicate Device:

The TMINI™ Miniature Robotic System (TMINI 1.1) is substantially equivalent in intended use, Indications for Use, design, materials, technology, operational principles and performance to the predicate, TMINI™ Miniature Robotic System, cleared via K232802.

Device Modification:

The purpose of this submission is to introduce a series of incremental modifications to the TMINI™ Miniature Robotic System to enhance efficiency, consistency and ease of use.

Device Description:

The TMINI 1.1 like its predicate, the TMINI™ Miniature Robotic System consists of three primary components: a three-dimensional, graphical, Preoperative Planning Workstation (TPLAN Planning Station), an Optical Tracking Navigation Console (TNav) and a robotically controlled hand-held tool (TMINI Robot) that assists the surgeon in preparing the bone for implantation of TKA components.

The TPLAN Planning Station uses preoperative CT scans of the operative leg to create 3D surface models for case templating and intraoperative registration purposes. The Planning Workstation contains a library of 510(k) cleared knee replacement implant(s) available for use with the system. The surgeon can select an implant model from this library. The planner/surgeon can manipulate the 3D representation of the implant in relation to the bone



TMINI™ Miniature Robotic System (TMINI 1.1) Traditional 510(k) Submission

model to optimally place the implant. The surgeon reviews and approves the case plan once the surgeon is satisfied with the implant selection, location and orientation. The data from the approved plan is written to a file that is used to guide the robotically controlled hand-held tool.

The hand-held robotic tool is optically tracked relative to optical markers placed in both the femur and tibia and articulates in two degrees-of-freedom, allowing the user to place bone pins in a planar manner in both bones. Mechanical guides are clamped to the bone pins, resulting in subsequent placement of cut slots and drill guide holes such that the distal femoral and proximal tibial cuts can be made in the pre-planned positions and orientations, and such that the implant manufacturer's multi-planer cutting block can be placed relative to drilled distal femoral pilot holes. If the surgeon needs to change the plan during surgery, it can be changed intraoperatively.

Intended Use:

The TMINI 1.1 like the predicate, the TMINI™ Miniature Robotic System is intended to assist the surgeon in providing software defined spatial boundaries for orientation and reference information to anatomical structures during orthopedic procedures.

Indications for Use:

The Indications for Use of the TMINI™ Miniature Robotic System (TMINI 1.1) and the predicate are the same (See **Table 1**). Both describe the use of a system that uses diagnostic imaging of the patient to allow a surgeon to plan and execute orthopedic total knee procedures. The only difference is that the device, that is the subject of this 510(k) submission, implements a series of incremental modifications to the system to enhance system efficiency, consistency and ease of use.

None of the changes made to the predicate, nor the aggregate of all changes, have altered the indications for use or testing, nor have they raised new type of safety or effectiveness questions.

Tables 1 and 2, below, identify the substantial equivalence of the TMINI™ Miniature Robotic System (TMINI 1.1) to the predicate, TMINI™ Miniature Robotic System cleared via K232802.

Table 1: Comparison of Intended Use and Indications for Use

Product	TMINI™ Miniature Robotic System (TMINI 1.1)	TMINI™ Miniature Robotic System	Conclusion
510(k) number	Subject Device	K232802	
Manufacturer	THINK Surgical, Inc	THINK Surgical, Inc	
Product Code	OLO	OLO	SAME
Regulation	21 CFR 882.4560	21 CFR 882.4560	SAME
Intended Use	Intended to assist the surgeon in providing software defined spatial boundaries for orientation and reference information to anatomical structures during orthopedic procedures.	Intended to assist the surgeon in providing software defined spatial boundaries for orientation and reference information to anatomical structures during orthopedic procedures.	SAME
Indications for Use	The TMINI™ Miniature Robotic System is indicated as a stereotaxic instrumentation system for total knee replacement (TKA) surgery. It is to assist the surgeon by providing software-defined spatial boundaries for orientation and reference information to identifiable anatomical structures for the accurate placement of knee implant components. The robotic device placement is performed relative to anatomical landmarks as recorded using the system intraoperatively and based on a surgical plan-determined preoperatively using CT based surgical planning tools. It includes a handheld robotic device, an optical sensor navigation system and accessories, software system, surgical instruments and accessories. The targeted population has the same characteristics as the population that is suitable for the implant(s) compatible with the TMINI™ Miniature Robotic System. The TMINI™ Miniature Robotic System is to be used with the following knee replacement system(s) in accordance with the	The TMINI™ Miniature Robotic System is indicated as a stereotaxic instrumentation system for total knee replacement (TKA) surgery. It is to assist the surgeon by providing software-defined spatial boundaries for orientation and reference information to identifiable anatomical structures for the accurate placement of knee implant components. The robotic device placement is performed relative to anatomical landmarks as recorded using the system intraoperatively and based on a surgical plan-determined preoperatively using CT based surgical planning tools. It includes a handheld robotic device, an optical sensor navigation system and accessories, software system, surgical instruments and accessories. The targeted population has the same characteristics as the population that is suitable for the implant(s) compatible with the TMINI™ Miniature Robotic System. The TMINI™ Miniature Robotic System is to be used with the following knee replacement system(s) in accordance with the	SAME

Product	TMINI™ Miniature Robotic System (TMINI 1.1)	TMINI™ Miniature Robotic System	Conclusion
	indications and contraindications: - Enovis™ EMPower Knee System® - Ortho Development BKS® and BKS TriMax® Knee System - Total Joint Orthopedics Klassic® Knee System - United U2™ Knee Total Knee System	indications and contraindications: - Enovis™ EMPower Knee System® - Ortho Development BKS® and BKS TriMax® Knee System - Total Joint Orthopedics Klassic® Knee System - United U2™ Knee Total Knee System	

Substantial Equivalence:

Both the TMINI™ Miniature Robotic System (TMINI 1.1), the subject of this submission, and the predicate device have the same intended use. Both are indicated as a stereotaxic instrumentation system for total knee replacement (TKA) surgery. It is to assist the surgeon by providing software-defined spatial boundaries for orientation and reference information to identifiable anatomical structures for the accurate placement of knee implant components during orthopedic procedures.

The robotic device placement is performed relative to anatomical landmarks as recorded using the system intraoperatively and based on a surgical plan determined preoperatively using CT based surgical planning tools. The difference between the new device and the predicate is that the new device incorporates a series of incremental changes that enhance system efficiency, consistency and ease of use. None of these changes either individually or in the aggregate alter the intended use, Indications for Use, design, materials, technology, or operational principles of the TMINI™ Miniature Robotic System and no new questions of safety or effectiveness resulted from the changes.

The Indications for Use of the TMINI™ Miniature Robotic System (TMINI 1.1) and the predicate are the same (See Table 1). Both describe the use of a system that uses diagnostic imaging of the patient to allow a surgeon to plan and execute orthopedic total knee procedures. The only difference is that the device, that is the subject of this 510(k) submission, implements a series of incremental modifications to the system to enhance system efficiency, consistency and ease of use.

Performance testing to verify the cutting accuracy of the subject device was conducted following similar test methods and acceptance criteria to those used for the predicate device. This testing demonstrated that the TMINI™ Miniature Robotic System (TMINI 1.1) met all test criteria and specifications. Validation testing, with methods and acceptance criteria similar to that used for the predicate device, was conducted using simulated surgical testing in a cadaver model and all test criteria were met.

Biocompatibility information for patient contacting materials and testing for the TMINI™ Miniature Robotic System were presented in predicate device submission K232802. There are no material changes to any of the direct patient contact components of the TMINI™ Miniature Robotic System as a result of TMINI 1.1 modifications included in this submission; therefore, no additional biocompatibility testing was required.

Substantial equivalence in technological characteristic and performance of the TMINI™ Miniature Robotic System to the predicate device is outlined in **Table-2** below:

Table-2: Substantial Equivalence

Product	TMINI™ Miniature Robotic System (TMINI 1.1)	TMINI™ Miniature Robotic System	Substantial Equivalence Conclusion
510(k) number	Subject Device	K232802	
Manufacturer	THINK Surgical Inc.	THINK Surgical Inc.	
Materials			
-Materials Used	Uses materials with a long history of use in orthopedic procedures or provided biocompatibility data consistent with ISO 10993 requirements	Uses materials with a long history of use in orthopedic procedures or provided biocompatibility data consistent with ISO 10993 requirements	SAME
Technological Characteristics			
-Major System Components	Planning and robot control software, robotic positioning device, navigation system, reusable and disposable instrumentation	Planning and robot control software, robotic positioning device, navigation system, reusable and disposable instrumentation	SAME
-Patient Imaging	CT images used to create a 3D model of the bone for surgical planning	CT images used to create a 3D model of the bone for surgical planning	SAME
-Preoperative planning workstation	TPLAN three-dimensional preoperative planning workstation	TPLAN three-dimensional preoperative planning workstation	SAME
-Surgical planning system	Technician guided surgical planning with surgeon review and approval on a desktop planning station	Technician guided surgical planning with surgeon review and approval on a desktop planning station	SAME
-Bone Marker Arrays for bone registration and tracking	Active markers on femur and tibia mounted onto the bones via an attachment assembly	Active markers on femur and tibia mounted onto the bones via an attachment assembly	SAME
-Surgical Exposure	Similar to traditional surgical exposure	Similar to traditional surgical exposure	SAME
-Patient/Robot Registration	Preoperatively determined landmarks are compared to intraoperatively identified landmarks to complete patient bone registration	Preoperatively determined landmarks are compared to intraoperatively identified landmarks to complete patient bone registration	SAME
-Camera Tracking Technology	Six camera overhead tracking with a wide-angle field of view	Six camera overhead tracking with a wide-angle field of view	SAME
-Cut guide positioning	Robotic device places bone pins in the correct plane, then cutguide or drill block is attached to the pins and bone	Robotic device places bone pins in the correct plane, then cutguide or drill block is attached to the pins and bone	SAME
-Intraoperative planning changes	Implant position can be fully adjusted, allowing deviation from the intended implant positioning philosophy and implant size	Implant position can be adjusted along bone axis only, preserving the intended implant positioning philosophy	Substantially Equivalent



TMINI™ Miniature Robotic System (TMINI 1.1)
Traditional 510(k) Submission

Product	TMINI™ Miniature Robotic System (TMINI 1.1)	TMINI™ Miniature Robotic System	Substantial Equivalence Conclusion
510(k) number	Subject Device	K232802	
Manufacturer	THINK Surgical Inc.	THINK Surgical Inc.	
-Bone Preparation Technique	A surgical saw is used to cut the bone through a cut guide	A surgical saw is used to cut the bone through a cut guide	SAME
-Intraoperative Anatomic Measurements	The tracked bone arrays and bone registration data are used to determine the knee flexion angle and varus/valgus laxity	The tracked bone arrays and bone registration data are used to determine the knee flexion angle and varus/valgus laxity	SAME
-Gap Balancing	Displays the maximum space in the medial and lateral compartments in millimeters with the knee in extension and in flexion allowing the surgeon to perform gap balancing, if desired.	Displays the maximum achievable angle between the medial and lateral compartments in degrees with the knee in extension and in flexion allowing the surgeon to perform gap balancing, if desired.	Substantially Equivalent
-TKA Component Implantation Technique	Implants are secured to the bone, either with or without cement using standard surgical technique provided by the implant manufacturer	Implants are secured to the bone, either with or without cement using standard surgical technique provided by the implant manufacturer	SAME
-Compatible Knee Implant Systems	- Enovis™ EMPOWR Knee System® -Ortho Development® BKS® and BKS TriMax® Knee System -Total Joint Orthopedics Klassic® Knee System -United® U2™ Knee System	- Enovis™ EMPOWR Knee System® -Ortho Development® BKS® and BKS TriMax® Knee System -Total Joint Orthopedics Klassic® Knee System -United® U2™ Knee System	SAME
Performance Testing			
-Full System Run Through Testing	Passed	Passed	SAME
Cutting Accuracy -Pin & Block Placement Accuracy -Cadaver Lab Validation Testing -System Gap Balance Accuracy	Passed Passed Passed qualitative surgeon assessment testing Passed quantitative measurement accuracy testing	Passed Passed Passed qualitative surgeon assessment testing	Substantially Equivalent
-User Needs Validation Testing	Passed	Passed	SAME
-Usability Testing	Passed	Passed	SAME
-Software Testing	Passed	Passed	SAME



TMINI™ Miniature Robotic System (TMINI 1.1) Traditional 510(k) Submission

Product	TMINI™ Miniature Robotic System (TMINI 1.1)	TMINI™ Miniature Robotic System	Substantial Equivalence Conclusion
510(k) number	Subject Device	K232802	
Manufacturer	THINK Surgical Inc.	THINK Surgical Inc.	
*Biocompatibility Testing			
-Cytotoxicity	*Passed	Passed	SAME
-Sensitization	*Passed	Passed	SAME
-Intracutaneous Reactivity	*Passed	Passed	SAME
-Acute Systemic Toxicity	*Passed	Passed	SAME
-Pyrogenicity	*Passed	Passed	SAME

* There are no material changes to any of the direct patient contact components of the TMINI™ Miniature Robotic System as a result of TMINI 1.1 modifications included in this submission; therefore, no additional biocompatibility testing was required.

Risk assessment was performed on the device in accordance with ISO 14971:2019 and THINK Surgical Risk Management procedures. Each change was assessed separately and in the aggregate through risk analysis and appropriate performance testing to evaluate the impact of the change. Risk analysis resulted in the identification of new instance of risks; however, no new clinical hazards were identified, and no new questions of safety or effectiveness were identified as a result of these changes. The risks identified have been mitigated to acceptable levels and there is no change in the overall risk profile of the device compared to the predicate cleared in K232802.

Conclusion

The TMINI™ Miniature Robotic System (TMINI 1.1) is substantially equivalent to the predicate, TMINI™ Miniature Robotic System (K232802), in the following ways:

- it has the same intended use,
- it has the same Indication for Use,
- it has the same technological characteristics and operating principles and incorporates the same design and materials.

Performance testing and risk analysis has demonstrated that the performance and risk profile of the TMINI™ Miniature Robotic System (TMINI 1.1) is substantially equivalent to that of the predicate device and does not raise any new question of safety and effectiveness.

THINK Surgical Inc. respectfully submits that this filing contains adequate information and data to demonstrate the substantial equivalence of the TMINI™ Miniature Robotic System (TMINI 1.1) to the legally marketed TMINI™ Miniature Robotic System cleared via K232802.