Supplementary Information

MicBall800-coated Metal Clip as a Novel Fluorescent Marker for Image-guided Laparoscopic Surgery

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1. Experimental

1.1. Materials

IRDye 800CW carboxylate was purchased from LI-COR Biosciences (Lincoln, NE, USA). Human serum albumin was obtained from SK plasma (Gyeonggi-do, Korea). Saline was purchased from DAI HAN PHARM CO., LTD. (Seoul, Korea). Cottonseed oil was acquired from Merck KGaA (Darmstadt, Germany). The standards reference materials for cytotoxicity such as high density polyethylene film and 0.25% zinc dibuthyldithiocarbamate (ZDBC) polyurethane film were obtained from Hatano research institute, Food and Drug Safety Center (Kanagawa, Japan). Minimum essential medium, fetal bovine serum and penicillin streptomycin were purchased from Gibco (Carlsbad, CA, USA). The male ICR mouse, female New Zealand with rabbits and female Dunkin Hartley guinea pigs were purchased from Samtako Inc. (Osan, Korea). The NCTC clone 929 cell line (L929 cell line) was obtained from Korea cell line bank (Seoul, Korea). The standards reference materials were used after sterilization at 121 ± 2°C for 20 mins. And all reagent were utilized without further purification.

1.2. Comparison of Concentration-dependent Fluorescence Intensities between IRDye800 and IRDye800-HSA

The fluorescence intensities of IRDye800 and IRDye800-HSA were measured using a multifunctional microplate reader (SPARK; TECAN Trading AG, Zurich, Switzerland). To prepare the stock solution, 0.7 mg of IRDye800 was dissolved in 1 mL of deionized water. The IRDye800-HSA complex stock solution was prepared similarly, with the dye dissolved in a mixture of 0.214 mL HSA (20 w/v% solid content) and 0.786 mL deionized water. Subsequently, these stock solutions were diluted to designated IRDye800 concentrations (100

to 1 μM). Fluorescence intensities were recorded at excitation/emission wavelengths of 730/806 nm for IRDye800 and 730/810 nm for IRDye800-HSA.

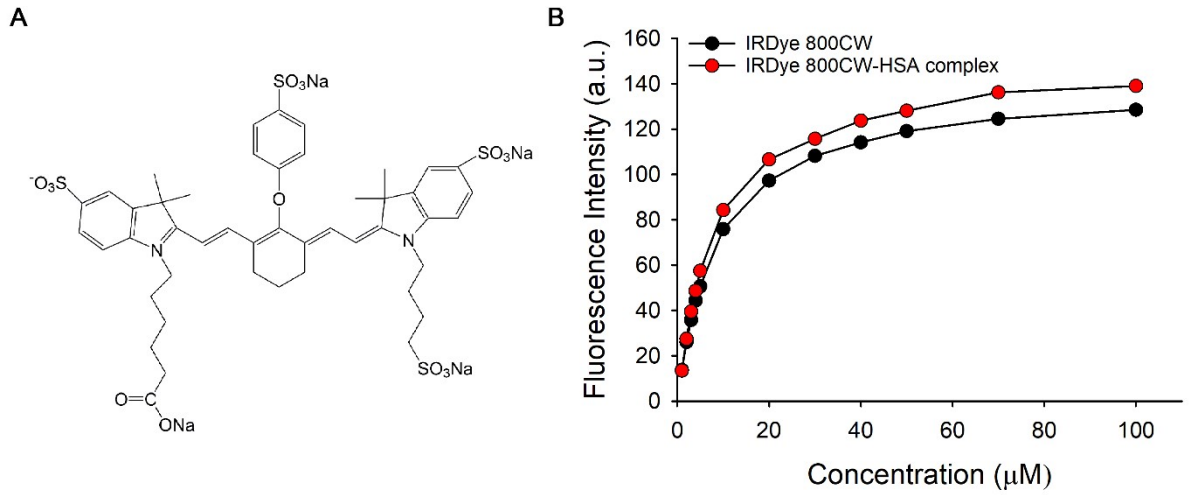

Fig. S1. (A) Molecular structure of IRDye800CW. (B) Concentration versus fluorescence intensity of IRDye800CW and IRDye800CW-HSA complex (ex. = 730 nm; em. = 806 nm for IRDye800CW, 810 nm for IRDye800CW-HSA)

1.3. Safety and Biocompatibility Tests of MicBall800 Clip

The safety and biocompatibility tests of the MicBall800 clip were conducted at the internationally certified testing agency, Korea Testing Certification Institute (KTC), located in Gunpo, Korea. These tests included a cytotoxicity test using L929 cells, an acute systemic toxicity test using mice, a skin sensitization test using guinea pigs, an intracutaneous reactivity test using rabbits, and a pyrogen test using rabbits. All samples were prepared in accordance with ISO 10993-12: Biological Evaluation of Medical Devices – Part 12: Sample Preparation and Reference Materials. Additionally, stability testing of the MicBall800 clip was conducted in compliance with the Ministry of Food and Drug Safety Notice No. 2020-12 (dated 2020.02.25), adhering to the common criteria standards for the biological safety of medical devices.

1.3.1. Cytotoxicity Test for MicBall800-coated Clip using L929 Cell Line

The cytotoxicity test for the MicBall800 clip was conducted according to the ISO 10993:2009 guidelines for Biological Evaluation of Medical Devices – Part 5: Tests for In Vitro Cytotoxicity. High-density polyethylene film (Lot No. C-221, Hatano Research Institute) served as the negative control, while 0.25% ZDBC polyurethane film (RB-C, Hatano Research Institute) was the positive control. The MicBall800 clip extract was prepared by mixing it with

cell culture medium MEM, containing 10% fetal bovine serum (FBS) and 2% penicillin-streptomycin, at a ratio of 1 mL medium per 0.2 g of the test sample. This mixture was agitated at 37 ± 1°C for 24 ± 2 h at 50 rpm. A media control group was prepared using the same method, omitting the test sample. Both control groups used the same extraction conditions, with a ratio of 20 mL per 2 g of substance.

The cytotoxicity testing employed the L929 (NCTC clone 929) cell line, cultured in minimum essential medium containing 10% FBS and 2% penicillin-streptomycin, maintained at 37 ± 1°C in a 5 ± 1% CO_2 incubator. Once the cells achieved 70-80% confluency, they were detached and seeded into a 6-well plate at a density of 2.0×10^5 cells/2mL/well (3 wells per group). After 24 ± 2 h incubation, the cell monolayer was examined under a microscope to ensure over 80% confluency. The existing culture medium was then replaced with 2 mL of the respective extraction solutions for the culture medium control, test sample, positive control, and negative control. These were cultured for an additional 48 ± 2 h. Qualitative evaluation was conducted by observing cell morphology, vacuole formation, detachment, cell lysis, and cell membrane condition under a microscope.

Table S1. Quantitative morphological grading of cytotoxicity for the extracts

Grade	Reactivity	Conditions of cultured cells
0	None	No isolation of intracytoplasmic granule, no cell lysis, no inhibition of cell growth
1	Slight	The cells exhibited a rounded shape, loose attachment, and loss of intracytoplasmic granules, with less than 20% showing alterations in morphology, Occasionally, dissolved cells were observed, along with slight growth inhibition.
2	Mild	The cells exhibited a rounded shape, with loss of intracytoplasmic granules in less than 50% of cells, and no extensive cell lysis observed. Growth inhibition of cells does not exceed 50%.
3	Moderate	The cells exhibited round-shaped, but dissolved cells did not exceed 70%. While the cell layer was not completely destroyed, it showed more than 50% growth inhibition.
4	Severe	Cell layer is largely or completely destroyed.

After the qualitative assessment, a quantitative evaluation was conducted to measure cell viability. Trypsin EDTA solution was added to each well, and the plates were incubated for 5

minutes to facilitate cell detachment. Following incubation, the cells were gently resuspended in the culture medium and then counted. The relative cell count (RCC, expressed as a percentage) was calculated to compare the viability of cells in the test group with those in the solvent control group. The RCC was determined using the following formula:

Relative cell count (RCC, %) = (Cell count of test group (cells/mL) / Cell count of media control group (cells/mL)) × 100%

Table S2. Qualitative analysis of L929 cell norphology following treatment with negative control, positive control, culture medium control, and MicBall800 clip extracts.

Group	Confluent Monolyaer[(a)]	Rounding (%)	Cells without intracytoplasmic granules (%)	Lysis (%)	Reactivity	Grade
Negative control 1	(+)	0	0	0	None	0
Negative control 2	(+)	0	0	0	None	0
Negative control 3	(+)	0	0	0	None	0
Positive control 1	(-)	100	100	100	Severe	4
Positive control 2	(-)	100	100	100	Severe	4
Positive control 3	(-)	100	100	100	Severe	4
Media control 1	(+)	0	0	0	None	0
Media control 2	(+)	0	0	0	None	0
Media control 3	(+)	0	0	0	None	0
Test group 1	(+)	<20%	<20%	<20%	Slight	1
Test	(+)	<20%	<20%	<20%	Slight	1

group 2						
Test group 3	(+)	<20%	<20%	<20%	Slight	1

[a] (+) : Present, (-) Absent

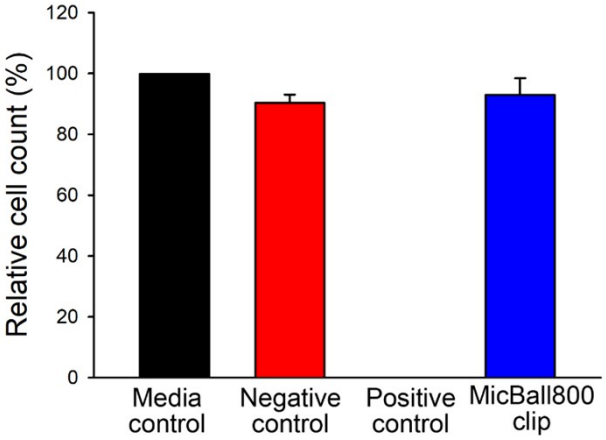

Fig. S2. Relative cell counts and viability of L929 cells treated with various controls and MicBall800 clip extract. This graph illustrates the cell viability percentages of cells treated with media control, negative control, positive control, and MicBall800 clip extract. Specifically, the cell viability for the negative control was recorded at 92.83%, while cells treated with the positive control showed 0.00% viability, indicating complete cytotoxicity. The cell viability of cells treated with the MicBall800 clip extract was 94.08%, demonstrating minimal cytotoxic effects compared to the controls.

1.3.2. Acute Systemic Toxicity Test of MicBall800 Clip in a Mouse Model

The acute systemic toxicity test of the MicBall800 clip was performed in compliance with ISO 10993-11: 2017, which outlines the Biological Evaluation of Medical Devices – Part 11: Tests for Systemic Toxicity. This test was conducted according to regulations and was approved by the Institutional Animal Care and Use Committee (IACUC-22-ASTX-080) at the Korea Testing Certification Institute. Sterilized saline solution and cottonseed oil were used as polar and non-polar extraction solvents, respectively.

The test utilized male ICR mice. To prepare the test item extracts, MicBall800 clip assemblies were agitated at 50 rpm for 24 ± 2 h at 70 ± 2°C, using 1 mL of extraction solvent per 0.2 g of the clip. A control blank extract was prepared using the same method but without the MicBall800 clip, serving as a baseline for comparison. The experimental groups were designated as follows: C1 (Polar control blank extract), C2 (Non-polar control blank extract),

T1 (Polar test item extract), and T2 (Non-polar test item extract). Both the test item extracts and control blank extracts were administered at a dose of 50 mL/kg, based on the individual body weights measured on the day of administration, without further dilution. The polar solvent groups (C1, T1) received a single tail vein injection, while the non-polar solvent groups (C2, T2) received a single intraperitoneal injection.

All animals were closely monitored for symptoms and body weight changes prior to administration, immediately after, at 4 ± 30 minutes, and at 24 ± 2 h, 48 ± 2 h, and 72 ± 2 h post-administration. Each group consisted of five animals. The results of these observations are presented in Tables S3 and S4

Table S3. Clinical signs observed in mice treated with control and test samples during acute systemic toxicity test. (NAD : No Abnormalities Detected)

Group	Animal ID	Clinical Signs					
		Prior to injection	Immediately after injection	4 hours after injection	24 hours after injection	48 hours after injection	72 hours after injection
C1	1	NAD	NAD	NAD	NAD	NAD	NAD
	2	NAD	NAD	NAD	NAD	NAD	NAD
	3	NAD	NAD	NAD	NAD	NAD	NAD
	4	NAD	NAD	NAD	NAD	NAD	NAD
	5	NAD	NAD	NAD	NAD	NAD	NAD
C2	6	NAD	NAD	NAD	NAD	NAD	NAD
	7	NAD	NAD	NAD	NAD	NAD	NAD
	8	NAD	NAD	NAD	NAD	NAD	NAD
	9	NAD	NAD	NAD	NAD	NAD	NAD
	10	NAD	NAD	NAD	NAD	NAD	NAD
T1	11	NAD	NAD	NAD	NAD	NAD	NAD
	12	NAD	NAD	NAD	NAD	NAD	NAD
	13	NAD	NAD	NAD	NAD	NAD	NAD
	14	NAD	NAD	NAD	NAD	NAD	NAD
	15	NAD	NAD	NAD	NAD	NAD	NAD
T2	16	NAD	NAD	NAD	NAD	NAD	NAD
	17	NAD	NAD	NAD	NAD	NAD	NAD
	18	NAD	NAD	NAD	NAD	NAD	NAD
	19	NAD	NAD	NAD	NAD	NAD	NAD
	20	NAD	NAD	NAD	NAD	NAD	NAD

※ C1(Polar Control Blank Extract), C2(Non-Polar Control Blank Extract), T1(Polar Test items Extract), T2(Non-Polar Test items Extract)

Table S4. Body weight change in mice treated with control and test samples during acute systemic toxicity test.

Group	Animal ID	Body Weight (g)				
		Prior to injection	24 hours after injection	48 hours after injection	72 hours after injection	Body Weight Gains
C1	1	18.45	18.61	20.21	22.04	+3.59
	2	20.25	20.65	21.31	22.33	+2.08
	3	20.53	20.28	21.36	22.95	+2.42
	4	22.72	23.01	24.24	26.36	+3.64
	5	22.74	24.04	25.01	28.00	+5.26
C2	6	18.66	19.51	20.90	21.83	+3.17
	7	20.10	20.60	22.14	22.91	+2.81
	8	21.07	22.18	23.82	24.78	+3.71
	9	21.88	22.42	23.96	24.29	+2.41
	10	22.81	23.10	24.18	25.03	+2.22
T1	11	19.18	20.07	22.02	23.33	+4.15
	12	20.07	20.77	22.75	23.95	+3.88
	13	21.24	21.96	24.05	25.38	+4.14
	14	21.68	22.05	23.90	25.11	+3.43
	15	22.96	23.49	25.19	27.98	+5.02
T2	16	19.32	20.44	21.85	23.49	+4.17
	17	19.86	20.72	22.66	23.55	+3.69
	18	21.51	22.50	24.26	25.26	+3.75
	19	21.55	22.10	23.63	24.59	+3.04
	20	23.10	23.38	24.75	25.65	+2.55

※ C1(Polar Control Blank Extract), C2(Non-Polar Control Blank Extract), T1(Polar Test items Extract), T2(Non-Polar Test items Extract)

After euthanasia, a comprehensive macroscopic examination of the organs within the cranial, thoracic, and abdominal cavities was conducted. This examination revealed no significant abnormalities in any of the observed tissues.

1.3.3. Skin Sensitization Test of MicBall800 Clip using Guinea Pigs

The skin sensitization test for the MicBall800 clip was conducted in accordance with ISO 10993-10: 2021, 'Biological evaluation of medical devices – Part 10: Tests for skin sensitization', specifically utilizing the Guinea pig maximization test (GPMT) as outlined in Section 6.5. Additionally, the procedure followed the OECD Guideline for Testing of Chemicals, Section 4 Health Effects, No 406 'Skin Sensitization', dated June 30, 2020. This test was performed under the regulations and approvals of the Institutional Animal Care and Use Committee (IACUC-22-GPMT-107) at the Korea Testing Certification Institute. Female Dunkin Hartley guinea pigs were used for the test. The preparation of test item extracts and control blank extracts was conducted using the same methodology as that described for the acute systemic toxicity test. Prior to application, all induction and challenge sites on the animals were shaved. For intradermal induction, 0.1 mL of mixed solutions, detailed in Table S5, was administered intradermally over an area measuring 2 × 4 cm^2 at three pairs of injection sites, as depicted in Fig. S3.

Table S5. Methods for preparing injection solutions according to injection sites for skin sensitization test.

Injection site	Control groups : C1, C2	Test groups : T1, T2
①	50:50 (v/v) mixture of solvent and FCA[(a)]	50:50 (v/v) mixture of solvent and FCA
②	Control blank extract	Test items extract
③	1:1 mixture of blank sample and 50:50 (v/v) mixture of solvent and FCA	1:1 mixture of test sample and 50:50 (v/v) mixture of solvent and FCA

[(a)] FCA : Freund's complete adjuvant

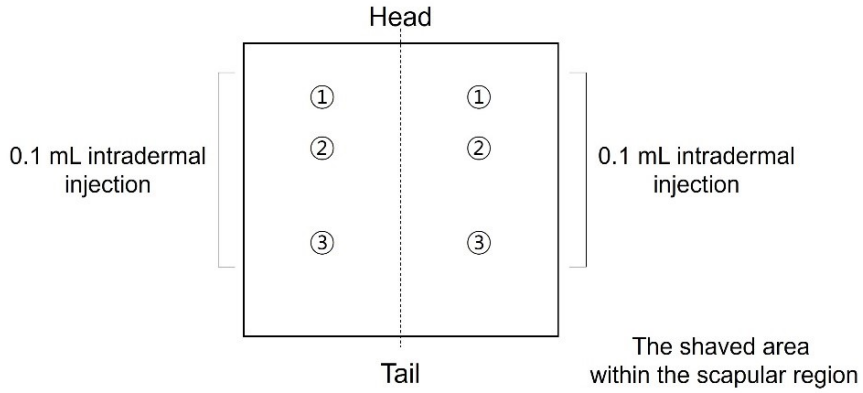

Fig. S3. The injection sites on guinea pig for skin sensitization test of MicBall800 clip.

For the local induction process, the induction sites on the guinea pigs were shaved 24 ± 2 h prior to induction. Subsequently, 0.5 g of 10% sodium dodecyl sulfate (SDS) was applied to these sites to enhance skin absorption. Six days post-intradermal induction, absorbent gauze pads measuring 2 × 4 cm^2 were soaked with the extraction solution and applied to the previously prepared intradermal induction sites. Occlusive dressings were then placed over the gauze to ensure contact and were left in place for 48 ± 2 h before removal.

After the completion of the induction phase on day 13, new absorbent gauze pads, each 2 × 2 cm^2, were soaked with the test and control substances. These pads were applied to untreated flank areas on both the left and right sides of all subjects. Occlusive dressings were again applied to these areas, and after 24 ± 2 hours, these dressings were removed. Skin reactions were observed and recorded twice, first at approximately 24 ± 2 hours and again at 48 ± 2 hours after the removal of the test substances.

The observed skin erythema and edema were graded at each application site using the Magnusson and Kligman grading system, as detailed in Table S6. This evaluation involved 5 animals in the control group and 10 in the test group, with results summarized in Table S7.

Table S6. Magnusson and Kligman grading scale for assessing erythema and edema

Grade	Reaction Description
0	No visible change
1	Discrete or patchy erythema
2	Moderate and confluent erythema
3	Intense erythema and swelling

Table S7. Results of skin sensitization test for MicBall800 clip extract in guinea pig model.

Test group		Grading of skin reactions			
Group	Animal #	After 24 ± 2 hours		After 48 ± 2 hours	
		Test specimen application site (Left)	Control solution application site (Right)	Test specimen application site (Left)	Control solution application site (Right)
T1	221026-61	0	0	0	0
	221026-62	0	0	0	0
	221026-63	0	0	0	0
	221026-64	0	0	0	0
	221026-65	0	0	0	0
	221026-66	0	0	0	0
	221026-67	0	0	0	0
	221026-68	0	0	0	0
	221026-69	0	0	0	0
	221026-70	0	0	0	0
T2	221026-71	0	0	0	0
	221026-72	0	0	0	0
	221026-73	0	0	0	0
	221026-74	0	0	0	0
	221026-75	0	0	0	0
	221026-76	0	0	0	0
	221026-77	0	0	0	0
	221026-78	0	0	0	0
	221026-79	0	0	0	0
	221026-80	0	0	0	0
Control group		Grading of skin reactions			
Group	Animal #	After 24 ± 2 hours		After 48 ± 2 hours	
		Test specimen application	Control solution application	Test specimen application	Control solution application

		site (Left)	site (Right)	site (Left)	site (Right)
C1	221026-81	0	0	0	0
	221026-82	0	0	0	0
	221026-83	0	0	0	0
	221026-84	0	0	0	0
	221026-85	0	0	0	0
C2	221026-86	0	0	0	0
	221026-87	0	0	0	0
	221026-88	0	0	0	0
	221026-89	0	0	0	0
	221026-90	0	0	0	0

1.3.4. Intracutaneous Reactivity Test of MicBall800 Clip in a Rabbit Model

The intracutaneous reactivity test for the MicBall800-coated clip was conducted in accordance with ISO 10993-23: 2021, which specifies guidelines for Biological Evaluation of Medical Devices – Part 23: Tests for Irritation, including Section 7.3, Animal Irritation Test by Intracutaneous (Intradermal) Administration. This test was performed under the regulatory compliance and was approved by the Institutional Animal Care and Use Committee (IACUC-22-INTD-092) at the Korea Testing Certification Institute.

Female New Zealand white rabbits were utilized for this test. Sample preparation for the test and control groups was consistent with the methods used in the acute systemic toxicity test. Approximately four to eighteen hours before the administration, the fur around the spine of the rabbits was shaved bilaterally. Each rabbit then received an intradermal injection of 200 μL of either the test or control substances (illustrated in Fig. S4), and the skin reactions at the injection sites were monitored.

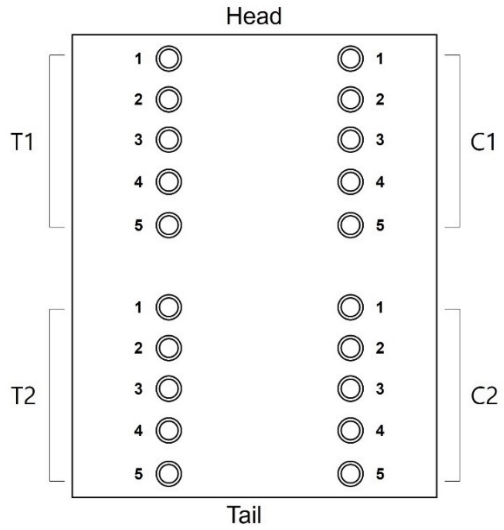

Fig. S4. Injection sites on rabbits for intracutaneous reactivity test of MicBall800 Clip. (T1: Polar test items extract, T2 : Non-polar test items extract, C1 : Polar control blank extract, C2 : Non-polar control blank extract).

Observations were made at 24 ± 2 h, 48 ± 2 h, and 72 ± 2 h post-administration, assessing the appearance of the injection sites. Skin reactions at each site were recorded according to the criteria detailed in Table S8, which includes grading for erythema, eschar formation, and edema. The overall test sample score was calculated by subtracting the control sample score from the test sample score. A final test sample score of 1.0 or less indicated that the test substance "meets the requirements of the intracutaneous reactivity test." Conversely, a score exceeding 1.0 suggested that the test substance "does not meet the requirements of the intracutaneous reactivity test." The results are documented in Tables S9 and S10. Throughout the test period, no abnormal clinical symptoms or changes in body weight were observed within the test group.

Table S8. Intracutaneous (intradermal) reaction grading scale

Intracutaneous (intradermal) reaction grading scale	
Reaction	**Grading scale**
Erythema and eschar formation	
No erythema	0
Very slight erythema (barely perceptible)	1
Well defined erythema	2
Moderate erythema	3

Severe erythema (beet redness) to eschar formation preventing grading of erythema	4
Edema formation	
No edema	0
Very slight edema (barely perceptible)	1
Well defined edema (edges of area well defined by define raising)	2
Moderate edema (edges raised approximately 1 mm)	3
Severe edema (raised more than 1 mm and extended beyond exposure area)	4
Maximum potential irritation score	8
Other abnormal changes observed on the skin area are recorded and archived.	

Table S9. Skin reaction score of intracutaneous reactivity of MicBall800 clip extract.

	Time after intradermal administration	Animal #											
		221026-1010				221026-1011				221026-1012			
		Test items extract		Control blank extract		Test items extract		Control blank extract		Test items extract		Control blank extract	
		ER	ED	ER	ED	ER	ED	ER	ED	ER	ED	ER	ED
Polar	24 ± 2 h	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
	48 ± 2 h	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
	72 ± 2 h	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0

Non-polar	24 ± 2 h	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
	48 ± 2 h	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
	72 ± 2 h	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0

※ ER : Erythema and eschar formation, ED : Edema formation

Table S10. Final test sample scores from the intracutaneous reactivity test of MicBall800 clip extract in rabbits

Solvent	Grade		Final test sample score
Polar	Test items extract	Control blank extract	0.0
	0.0	0.0	
Non-polar	Test items extract	Control blank extract	0.0
	0.0	0.0	

1.3.5. Pyrogen Test of MicBall800 clip in a Rabbit Model

The pyrogen test for the MicBall800 clip was conducted in accordance with ISO 10993-11: 2017, 'Biological Evaluation of Medical Devices – Part 11: Tests for Systemic Toxicity,' specifically referencing Annex G, which provides information on material-mediated pyrogens. This test also adhered to the standards set forth in the United States Pharmacopeia 43, National Formulary 38 (USP NF38), General Chapter <151>, Pyrogen Test, updated in 2020. Compliance with these guidelines was ensured, and the test was approved by the Institutional Animal Care and Use Committee (IACUC-22-PYRO-079) at the Korea Testing Certification Institute.

Female New Zealand white rabbits were used in this study. Sample preparation for the test item extracts followed the protocol established in the acute systemic toxicity test. The extracts were heated to above 37 ± 2°C for 10 min on a heating block to prepare the injection solution. This solution was then administered intravenously through the auricular vein at a dose rate of 10 mL per kg of rabbit body weight. Body temperatures of the rabbits were measured at 30-min intervals for three hours both before and after the injection to monitor for any pyrogenic response. The experiment was conducted in triplicate to ensure reliability and reproducibility of the results.

The outcomes are depicted in Fig. S5. Based on the conditions of this test, the MicBall800 clip did not exhibit material-mediated pyrogenicity. Therefore, the test substance was determined to be negative for pyrogens.

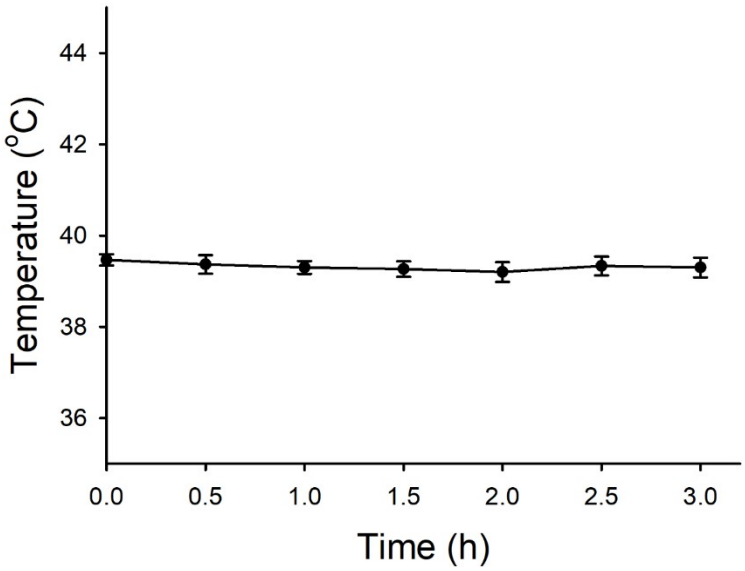

Fig. S5. Temperature changes in rabbits treated with MicBall800 clip extract during the pyrogen test.

Movies

Movie S1 Laparoscopic fluorescence imaging of MicBall800 clip

Movie S2A Ex vivo NIR fluorescence imaging of stomach tissues of porcine (inside view). MicBall800 Clips are marked on the inner surface of stomach.

Movie S2B Ex vivo NIR fluorescence imaging of stomach tissues of porcine (outside view). MicBall800 Clips are marked on the inner surface of stomach.

Movie S3A Ex vivo NIR fluorescence imaging of colon tissues of porcine (inside view). MicBall800 Clips are marked on the inner surface of colon.

Movie S3B Ex vivo NIR fluorescence imaging of colon tissues of porcine (outside view). MicBall800 Clips are marked on the inner surface of colon.

Movie S4 Endoscopic marking of target sites using MicBall800 Clips.

Movie S5A-B In vivo NIR fluorescence imaging of porcine stomach during laparoscopic operation. Marking sites of MicBall800 Clips are clearly detected in real-time during laparoscopic observation.