News Release

Title

Developed a medical-optical device that makes it possible to illuminate anywhere in the body! ; Success in Development of Light Irradiation System and Device（**ET-BLIT: Endovascular Therapy-Based Light Illumination Technology**）

~ Towards for clinical application of various phototherapy technologies ~

Key Points

- Device development in light therapy is lagging, and new technology that illuminates anywhere in the body is needed.
- Medical photonic devices are needed to expand the indications for approved near-infrared photoimmunotherapy, which is considered the fifth cancer treatment.
- Based on the endovascular therapy*1, which is widely used in the treatment of myocardial infarction and cerebral infarction, this research has succeeded in developing a system and device to safely and efficiently deliver light via blood vessels throughout the human body to the affected area, especially to tissues where light cannot reach if irradiated from outside the body. We named this technology (ET-BLIT: Endovascular Therapy-Based Light Illumination Technology).
- In animal experiments, we confirmed that light irradiated from within blood vessels reaches extravascular tissues with high efficiency.
- In the future, it is expected to contribute as a clinically applied technology for various phototherapy techniques as well as cancer therapy, including near-infrared photoimmunotherapy and photodynamic therapy.

Summary 1

Asashi Intecc, CO.,LTD researcher Toshihiko Tsukamoto **(first author)**, and Designated Lecturer **Kazuhide Sato (co-first author, corresponding author/ last author)** Nagoya University Graduate School of Medicine, in the department of respiratory medicine, Institute for Advanced Research, as an industry-academia joint research project, developed a light irradiation technology based on endovascular therapy technology, which is widely used in the treatment of myocardial infarction and cerebral infarction. We named the device system for ET-BLIT: Endovascular Therapy-Based Light Illumination Technology. ETBLIT is suitable for deep tissue inside the body, where light cannot reach during treatment with current near-infrared photoimmunotherapy.

Near-infrared photoimmunotherapy (NIR-PIT) is a new cancer treatment method developped by Dr. Hisataka Kobayashi at the National Cancer Center (NCI/NIH) in 2011. A complex of an antibody that specifically recognizes proteins expressed by cancer cells and a photoabsorber, IR700*2 , is synthesized, and irradiation of near-infrared light around 690 nm while the complex is bound to the target protein on the cell surface destroys the cells.

In NIR-PIT, it is necessary to irradiate the above complexes accumulated on cancer cells with light. If the device for enabling to lighten the part deep inside body, we could expand the application of near-infrared immunotherapy and deliver a new treatment technology to cancer patients.

In this study, we focused on the endovascular treatment technology that ASAHI INTECC, Inc. has accumulated over the years, and aimed to further implement a light irradiation system to the existing endovascular treatment devices. As a result, we succeeded in developing a thin device that can be delivered to the whole body via small blood vessels. In animal experiments, we succeeded in delivering light to extravascular tissues with high efficiency, high selectivity, and high safety by light irradiation from inside the blood vessel. We named this light irradiation technology and device (ET-BLIT: Endovascular Therapy-Based Light Illumination Technology).

This research was supported by the Program for Developing Next-generation Researchers (Japan Science and Technology Agency); JSPS KAKENHI (18K15923, 21K07217); CREST; FOREST-Souhatsu (JST); etc.

The paper was published in *Ebiomedicine (Cell Press, and the Lancet)*, which is an journal of medical science (electronic version dated October 5, 2022).

Summary 2

Research Results

By combining light irradiation technology with the technology and devices used in endovascular therapies such as myocardial infarction and cerebral infarction treatment, we have succeeded in developing a small diameter light irradiation device and treatment system (ET-BLIT: Endovascular Therapy-Based Light Illumination Technology) that can be used intravascularly. ET-BLIT: Endovascular Therapy-Based Light Illumination Technology), a device that can be used intravascularly.

This development enables the delivery of the light irradiation device to the affected area easily using the same method as in conventional endovascular therapy, and in combination with the accurate control technology of the light irradiation position and real-time blood temperature measurement technology incorporated in this device, it is possible to deliver NIR light from inside a blood vessel to the target tissue outside the vessel with high efficiency and high safety. The device is capable of irradiating near-infrared

light from inside blood vessels to target tissues outside blood vessels with high efficiency and high safety.

This evaluation was conducted in animal experiments using pigs, which have blood vessels similar to those of humans, and the device was easily delivered to blood vessels such as the liver and kidneys, and light was successfully detected outside of blood vessels in all blood vessels evaluated.

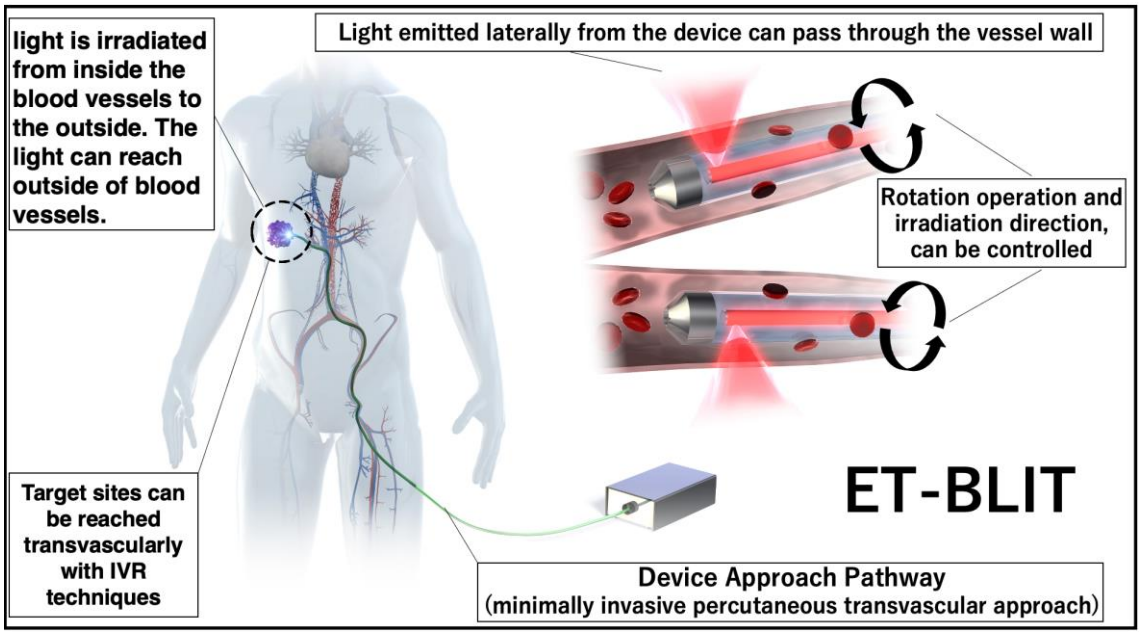

Figure: ET-BLIT: Endovascular Therapy-Based Light Illumination Technology

Research Summary and Future Perspective

Since endovascular therapy for the treatment of myocardial infarction and cerebral infarction is currently a widely used treatment technique and technology around the world, the hurdle for moving the newly developed light irradiation system (ET-BLIT) into clinical application is considered to be low in terms of both software and hardware. Therefore, it is expected that the ET-BLIT device will be further optimized and applied as a technology for the transition of many phototherapies, including near-infrared photoimmunotherapy, to clinical applications by conducting basic studies and non-clinical studies for the transition to clinical trials. We will continue to develop technologies to support the next generation of phototherapy from the device side and contribute to patients.

Publication

Toshihiko Tsukamoto[#,1], Yuko Fujita[1], Manabu Shimogami[1], Kenji Kaneda[1], Takanari Seto[1], Kotaro Mizukami[1], Miyoko Takei[1], Yoshitaka Isobe[2], Hirotoshi Yasui[2], Kazuhide Sato[#,2,3,4,5]

[1]Asahi Intecc Co., LTD.; Global Headquarters, R and D Center; 3-100 Akatsuki-cho, Seto, 489-0071, Aichi, Japan.

[2] Respiratory Medicine, Nagoya University Graduate School of Medicine, 65, Tsurumai-cho, Showa-ku, Nagoya 466-8550, Nagoya, Japan.

[3] Nagoya University Institute for Advanced Research, Advanced Analytical and Diagnostic Imaging Center (AADIC) / Medical Engineering Unit (MEU), B3 Unit, 65, Tsurumai-cho, Showa-ku, Nagoya 466-8550, Nagoya, Japan.

[4]FOREST-Souhatsu, CREST, JST, Tokyo, Japan

[5] Nagoya University Institute for Advanced Research, S-YLC, Furo-cho, Chikusa-ku, Nagoya 464-8601, Nagoya, Japan.

[#] These authors equally contributed to this work.

Inside the body light delivery system using endovascular therapy-based light illumination technology

Ebiomedicine

DOI; 10.1016/j.ebiom.2022.104289

Japanese ver.

https://www.med.nagoya-u.ac.jp/medical_J/research/pdf/Ebi_221006.pdf