

Design of the Portable Surgical Fluorescence Microscopy

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Abstract

In this paper, the development of the portable pen-type probe with excellent operational convenience and image quality can complement the disadvantages of conventional surgical microscopy for fluorescence diagnosis. The optical source parameter of a pen-type probe and indocynine green (ICG) information of fluorescence substance inserted to Rat library in the simulator. Therefore, the fluorescence expression start and up-take to liver in the Rat was simulated.

1. Introduction

Recently, the technique of the surgical microscopy is rapidly growth and the microscopy is candidate for color image guided diagnosis. However, the surgical microscopy is difficult mobile performance and the system is bulky [1]. In addition, the disadvantage of microscopy has photo bleaching, and blind spot phenomenon, scattering, and long distance of beam focusing [2, 3]. In this paper, the potable pen type probe with surgical microscopy is developed. The developed pen type probe is possible to real-time observation to tumor.

2. Surgical fluorescence image guide and pen type probe circuit

The diagnosis of tumor color image with fluorescence substance using surgical microscopy for cancer patient is shown in Fig.1. Then, the pen type probe is used for laser diode because of the laser diode is able to strong beam focusing. The laser diode has variety code type. Then, the C-type structure is operated by wavelength of 785nm as shown Fig.2 [4].

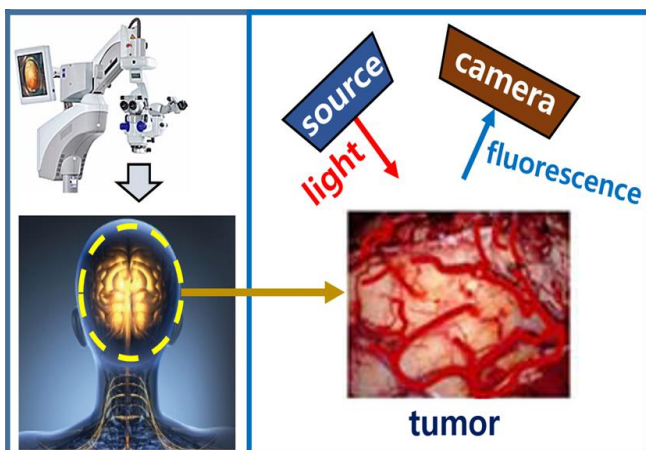


Fig.1. Diagnosis for microscopy of surgical fluorescence image guide

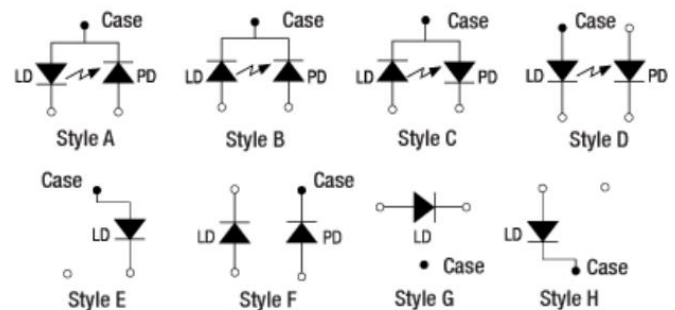


Fig.2. Schematic for code type of laser diode

The drive circuit for laser diode is shown in Fig.3 [4]. From the figure, the supply for voltage and current are 5 V and 120 mA and the threshold current is above 35 mA.

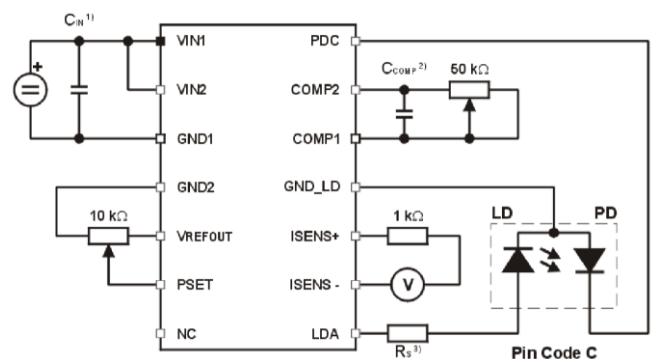


Fig.3. Drive module circuit for laser diode

3. Structure of the pen type probe

Fig.4 shows the block diagram of pen type probe and the proposed pen type probe is composed of endoscope camera, laser diode, drive module, power control unit, and on/off controlled switch module as shown in Fig.5. From the figure, the laser diode has excitation wavelength of 785 nm and excitation power of average 30 mW and the emission wavelength of 815 to 830 nm fluorescence material, respectively. The photograph of developed pen type probe is shown in Fig.6.

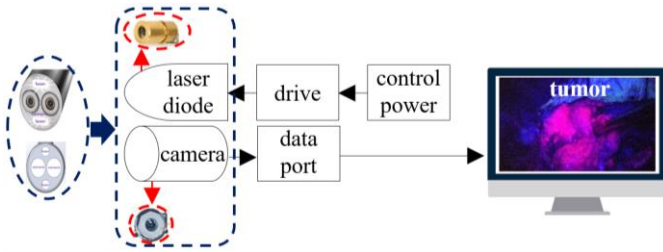


Fig.4. Block diagram of the pen type probe structure

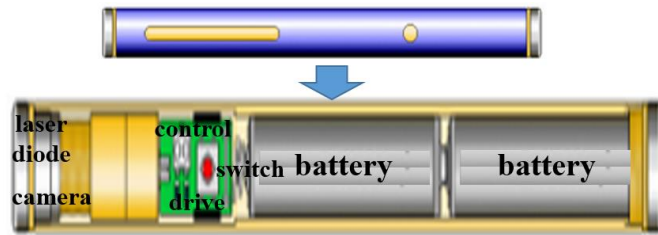
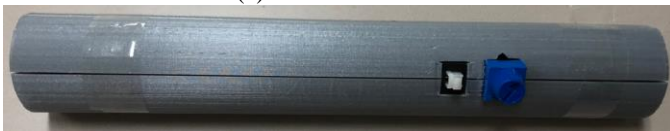


Fig.5. Layout of the pen type probe



(a) Inner structure



(b) outer structure

Fig.6. Fabrication of the pen type probe

4. Simulation of the fluorescence brightness using Rat model

The layout of the rat using 3D simulation tools as shown in Fig. 7. From the figure, the parameter of a rat has male and 320 g with 8 weeks. Then, the optical source parameters of the pen-type probe inserted to simulation tools and the ICG parameter inserted to rat vessel unit. Thus, the capacity and volume of ICG and normal saline are 25 mg and 10 %, respectively. Fig.8 shows the simulation results for brightness and up-take progress of the fluorescence. From the figure, the brightness times are 1 to 50 min. and the up-take at liver start time is 55 min.



Fig.7. library of the RAT

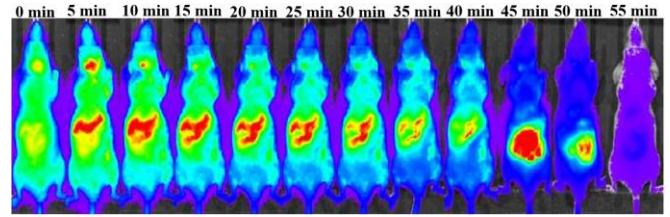


Fig.8. Simulation results for brightness and up-take of the fluorescence

5. Conclusion

In this paper, the mobile small size of pen type probe for surgical fluorescence microscopy fabricated. The developed pen type probe is possible to real-time diagnosis while the surgical situation and the image diagnosis result could observed to external monitor system through communication cable. The cancer patient can be enough for tumor removal by pen-type probe usage.

Acknowledgment

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