

Design of a Visual Needle Searching Device in Operating Room

Nana Ren, Dongqin Peng, Mingxia Li, Chang Ling*, Duan Lin, Yuan Gao

Guiyang Maternal and Child Health Care Hospital. Guiyang Children's Hospital, Guizhou 550000, Guiyang, China.

Abstracts: **Objective:** a visual needle searching device in operating room is designed to quickly find surgical suture needles. **Method:** on the basis of referring to the current needle searching method in the operating room, the magnetic strength adjustment, data recording and export, and harmless treatment of the adsorbed suture needle are added. What is more, the functions of adjusting the total length of the telescopic connecting rod as required, rotating the telescopic connecting rod at any angle, alarm prompt after finding the sewing needle and LED lighting. **Result:** a visual needle searching device in operating room was designed, which could solve the problems that the magnetic strength of the permanent magnet of the existing needle finder was difficult to control, the electromagnet could not directly judge whether the electric energy of the battery met the use requirements, and could not record the use times, frequency and needle searching time. **Conclusion:** the visual needle searching device designed in this paper can provide a more time-saving, labor-saving, easier, more convenient and safer needle searching device for suture needle searching in the operating room, and can meet the requirements of fast work rhythm and high efficiency in the operating room.

Keywords: Operating Room; Suture Needle; Device; Visualization

Introduction

Surgical suture needle is the most commonly used instrument for surgical suture of patients. Surgical suture needles of different models, specifications and materials are widely used in various operations. The number of suture needles in one operation can sometimes be as many as dozens ^[1]; The volume of the surgical suture needle is small. Once it falls during the operation, the medical staff must stop the operation until the surgical suture needle is found to ensure that it is not left in the patient. However, the needle searching process prolongs the operation time, affects the operation process and increases the risk in the operation process of the patient ^[2]. An effective needle finder in the operating room is an important means to solve the problem of quickly finding falling surgical stitches, ensure surgical safety and improve the management quality of the operating room. Therefore, a visual needle finder in the operating room is designed in this paper (patent Publication No.: CN209186971U).

1. Structure and function of needle searching device in visual operating room

1.1 Structure of needle searching device in visual operating room

The needle searching device in the visual operating room is mainly composed of a base, a universal joint, a telescopic connecting rod and a controller (see Fig. 1). The base shell mechanism is equipped with needle suction disc, coil, positive and negative conductor, battery, needle storage box, elastic support, small needle suction rod, disinfection box, power switch, etc; The universal joint is connected with the base and the telescopic connecting rod, and the controller is fixed to the telescopic connecting rod through a bolt pair; The controller includes display instrument, LED lamp, magnetic strength adjustment knob, USB interface, alarm, lighting switch, etc.

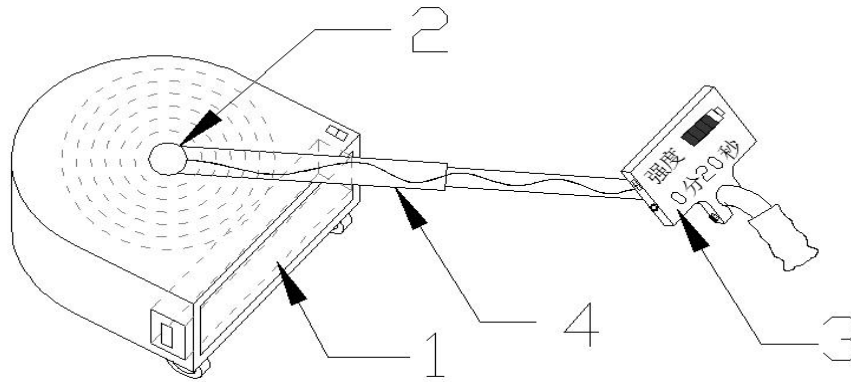


Fig. 1 Overall structure diagram of needle searching device in visual operating room
(Note: 1. Base, 2. Universal Joint, 3. Controller, 4. Telescopic Link)

1.2 Functions of needle searching device in visual operating room

1.2.1 Adjust the magnetic strength according to the size of the sewing needle and find the needle accurately

At present, there are two kinds of needle seekers in clinical use: permanent magnet and electromagnet, but both have their shortcomings. The magnetic strength of permanent magnet needle finder is difficult to control in the process of use^[3]; The electromagnet needle finder cannot determine whether the electric energy of the battery meets the use requirements, and it is easy to miss the searched places due to insufficient electric energy, resulting in unnecessary expansion of the search scope and extension of the search time^[4]; The needle searching device designed in this paper can adjust the resistance of the knob through the magnetic strength on the controller, and then adjust the current, so as to achieve the purpose of adjusting the magnetic strength grade of the coil, and solve the problem that the magnetic strength of the existing needle finder permanent magnet is difficult to control, so as to meet the adsorption requirements of surgical suture needles of different sizes.

1.2.2 Data recording to improve the management quality of operating room

When using the conventional needle finder, the use times, frequency and needle searching time cannot be recorded, which is not conducive to the quality management and control of the operating room. The display instrument on the controller of the needle searching device designed in this paper can display the information such as the use times of the needle searching device, battery power, needle searching time, the times of successful adsorption of sewing needles, magnetic strength, needle searching alarm and so on; Through the USB interface, the information such as the use times of needle finder and the times of successfully adsorbing suture needles can be exported in different periods for the management and analysis of the operating room, which can strengthen the quality management and control of the operating room and provide data support for the quality management and control of the operating room.

1.2.3 Harmless treatment of suture needle to avoid occupational exposure

Most of the needles dropped during the operation have already touched the blood and body fluid of the patients. When they remove the stitches adsorbed by the needle, they may be exposed to occupation injuries such as needling injuries. Especially for the needles used in the surgical patients who are diagnosed with infectious diseases or unknown infection, occupation exposure will cause great harm and pain to the needles. The visual needle searching device designed in this paper adsorbs the needle through a small needle suction rod after the needle is found, and puts it into the disinfection box in the

needle searching device for rapid disinfection, so as to achieve harmless treatment, so as to prevent unnecessary occupational exposure when taking out the contaminated needle.

1.2.4 Other auxiliary functions, showing humanization in details

When using the needle searching device designed in this paper, and the total length of the telescopic connecting rod can be adjusted to facilitate the use of the operator; The telescopic connecting rod can rotate at any angle on the base through the universal joint, so as to meet the needs of different positions; After finding the sewing needle, the alarm on the controller immediately lights up to remind the operator that the sewing needle has been found; LED lights are set under the display to meet the lighting requirements in the gaps with insufficient light, under the operating bed and under the anesthesia machine.

2. Discussion

Suture needle loss is common during operation. Researchers such as Mo Hong, Zhang Xiaoqin and Zuo Zhenfang reported the falling of suture needle from the operating table^[5-7]. The main reasons why the surgical suture needle falls from the operating table are: the needle holder does not hold the suture needle in place; Improper operation of medical staff when transferring needle holder; The suture needle was placed irregularly during the operation; The friction of surgical instruments produces magnetism to remove the suture needle; New doctors, nurses and trainees are not proficient in operation^[7-8]. Once the suture needle falls during the operation, the medical staff must stop the operation until the surgical suture needle is found. If it is not found after repeated times, the operation can be continued only after X-ray taken by the bedside C-arm machine to ensure that it is not left in the patient^[9]. After the operation, the fallen suture needle must be found out to avoid affecting the management of the suture needle of the next operation; The needle seeking process not only prolongs the operation time and increases the risk of patients in the operation process, but also affects the mood of operators, hand washing nurses and itinerant nurses and the use frequency of the operation room.

At present, the lost suture needle is searched by some original means, such as naked eye search, simple permanent magnet and electromagnet device, and surgical towel. Because the suture needle is small, the color is not easy to identify, and the search area is large, the search process is time-consuming and laborious. Especially for places where the light source under the anesthesia machine and operating table is insufficient and the magnetic strength is difficult to reach, and it increases the difficulty of searching.

Compared with other needle searching methods, the visual needle searching device in the operating room designed in this paper increases the functions of magnetic strength adjustment, data recording and export, harmless treatment of the adsorbed suture needle, adjusting the total length of the telescopic connecting rod according to the needs, rotating the telescopic connecting rod at any angle, alarm prompt after finding the suture needle and LED lighting; It provides a more time-saving, labor-saving, easier, more convenient and safer needle searching device for suture needle searching in the operating room, so as to meet the requirements of fast work rhythm and high efficiency in the operating room.

References

- [1] Chen F, Zhang J, Yang M, etc. Design and application of surgical towel with adsorption suture needle in operating room [J]. Chinese Journal of nursing 2014;49(12):1527.
- [2] Jiang H, Han X. Application effect of self-made suture needle storage board in intraoperative suture needle management [J]. Chinese Journal of modern nursing 2019;25(19):2484-2486.
- [3] Zhou L, Zhou L, Zhou L, Huang Y. Development and application of handheld permanent magnet needle finder with light source guidance [J]. Chinese Journal of modern nursing 2011;17(13):1583-1585.
- [4] Chongqing Medical University. A new medical needle Finder: China, CN 201711445965.1 [P]. 2018-06-15.
- [5] Mo H, Gong R, Lai L, etc. Retrospective analysis of 240 surgical related near misses [J]. West China medicine 2017;32(12):1906-1909.
- [6] Zhang X. Common nursing safety hazards in operating room and their prevention [J]. Chinese practical medicine 2015;(21):291-292.

[7] Zuo Z. Cause analysis and Countermeasures of surgical suture needle loss [J]. Frontier of medicine 2013;(29):379-379,380.

[8] Li R, He L. Current situation analysis and Countermeasures of inventory management of operating items in operating room [J]. Journal of nursing of PLA 2013;30(7):54-56.

[9] Lv R, Xiong M, An M, etc. Cause analysis and Countermeasures of surgical suture needle loss [J]. Journal of Zunyi Medical College 2009;32(3):324-325.

Fund Project:

1. 2019 Scientific Research Project of Guizhou Nursing Society GZHLKY 201924

2. High Level Innovative Youth Health Talent Training Plan Project [2020] ZHUWEIJIAN technology contract ZI No. 025