The design thinking of people-oriented in intravenous infusion treatment device

abstract

People always think that design has three dimensions: aesthetics, technology and economy, but more importantly, the fourth dimension: human nature. An innovative, people-oriented design thinking to solve problems has gradually emerged. In the design thinking of medical devices, more and more design teams give up the in-depth study of complex problems and adopt novel, extensive and horizontal interdisciplinary expansion methods. It emphasizes more psychological factors, including the main principles of empathy and user-centered. The main goal of this holistic approach is to focus the expectations, behaviors and requirements of every stakeholder in the ecosystem at the center of the design process. This method builds a broader, multi vision and more productive design team. Every stakeholder, whether doctor, nurse, patient or patient's family member, is placed in the process of design and proposal, and keeps the process moving repeatedly to obtain more friendly medical device products. This paper focuses on the design method of people-oriented in the treatment device of intravenous infusion. Starting from the design methodology, it shows the advantages of the quality device of intravenous infusion and brings a new combination for the nursing of intravenous injection.

Key words: design thinking; people-oriented; intravenous infusion treatment device

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Imagine a scene: many cancer patients will experience a lot of inconvenience and distress brought by the disease to their daily life in the process of

pre-operative treatment and post-operative rehabilitation. This dilemma is a dilemma they are facing every day. It comes from the psychological pressure of patients during treatment, as well as the appearance and other pressures in the rehabilitation process. Medical device designers have been working hard to Effective product design to help these groups, they design a variety of love, empathy and inclusive products for different groups of people facing the difficulties, to maximize the convenience for more users, including people of different ages for different patients, so that even patients with severe illness can live and work as normal as ordinary people. Sometimes, high-tech products are not the only good design. Sometimes designers bring themselves into the situation of patients to create empathy, combine unique and ingenious creative design with the needs of patients, start from a more subtle and soft place to improve the plight, reduce some difficulties and add some fun to the cold and repetitive treatment process. Successful medical device design has gentle power, which can improve the quality of life of patients invisibly, and help patients rebuild their self-esteem and regain their confidence in life.

The most noteworthy psychological characteristics of intravenous infusion population

Many medical devices are designed to care for cancer patients only focusing on their treatment process or precise treatment, but ignoring the psychological state that more cancer patients want to live the same life as ordinary people. Pay attention to the psychological state of patients, can make patients more helpful to the condition. (looking for literature support) for example, the British Design Council, together with the Ministry of health and health care experts from the Helen Hamlin center of the Royal Academy of art, has developed new designs and has contributed to "patient dignity design" to solve different privacy and dignity problems of patients from a design perspective. Matt hunter, chief design officer of the design committee, said the groundbreaking plan shows that redesigning simple handicrafts can improve the dignity and control of patients. Mat Hunter, chief design officer of the design committee, said: "positive patient experiences are increasingly seen as important in healthcare

- your feelings can lead to faster recovery, less demand for painkillers, more demand for painkillers - a groundbreaking initiative that shows that redesigning simple handicrafts can improve patient dignity And control. ″

Therefore, in the design of medical devices, more and more people-oriented ideas are gradually concerned. In all aspects, to achieve safety, aesthetic feeling and sustainable treatment is the problem of long-term subcutaneous work of intravenous infusion treatment device. From the perspective of people-oriented orientation, from the perspective of patients' aesthetic psychology, design interaction process, and after use by medical staff, to explore the issue that cancer patients' intravenous infusion treatment should get more full attention in human nature, and also hope that this research can bring medical staff, product research related personnel, and improve patients from the perspective of comprehensive care In order to promote the development of more and better intravenous infusion treatment devices.

Intravenous infusion therapy

Intravenous infusion therapy is one of the important ways of drug administration in clinical rescue and treatment. With the development of medicine, the treatment technology of intravenous infusion has developed step by step, from traditional intravenous infusion to peripheral vein indwelling trocar infusion, then to deep vein puncture central vein catheterization (CVC) and peripheral vein puncture central vein catheterization (PICC), while the implanted vein infusion port (tiap) In recent years, tivap is the latest technology of clinical intravenous infusion. It is the first choice of closed intravenous infusion device in the world, which can be kept in the body for a long time and implanted under the skin completely. Because its clinical application can significantly reduce the pain and discomfort caused by frequent venipuncture, it has gradually developed into an effective, safe and long-term infusion device It greatly improves the quality of life of patients. It can be seen from the application progress of intravenous infusion technology that the routine nursing operation of intravenous infusion has been given a new connotation: people-oriented, patient-centered, with the purpose of reducing patients' pain, with the objective of facilitating clinical nursing operation,

improving work efficiency and nursing quality.

Types of intravenous infusion

Traditional intravenous transfusion

That is to say, the technique of peripheral superficial vein infusion with metal needle can be divided into straight needle puncture and scalp needle puncture. Straight needle puncture is no longer used clinically. The commonly used method of venous puncture is scalp needle puncture of peripheral superficial vein, which is mainly used for short-term infusion treatment, good conditions of venous puncture, cooperation of patients, small stimulation of drugs on blood vessels, etc. Because of repeated puncture of peripheral superficial vein for a long time, it is easy to cause complications such as drug leakage. At present, most countries have cancelled the use of scalp acupuncture.

Indwelling trocar in peripheral vein

Peripheral vein indwelling trocar is the first method of intravenous transfusion without needle. This method has the advantages of less puncture times, less stimulation, safety, rapidity, easy operation, easy fixation, less workload of nurses, and less pain of patients. The peripheral vein indwelling trocar is suitable for patients who need repeated venipuncture and transfusion time is 3-10 days. Unskilled puncture technique, incorrect sealing method and patient's own disease can cause liquid leakage, which will lead to blockage and detachment of the indwelling needle and affect the indwelling time.

Central venous catheterization (*CVC*)

According to the different puncture points, CVC can be divided into subclavian vein, superior vena cava catheterization through internal jugular vein and inferior vena cava catheterization through femoral vein. In the 1990s, CVC began to be used in the intravenous administration of tumor patients, which not only established a good venous access for chemotherapy patients, but also relieved the damage of chemotherapy drugs to the superficial vein, and was convenient for

high nutrition treatment. The puncture point of subclavian vein catheterization is under the clavicle. The catheterization can be fixed in front of the chest, which does not affect the movement of the limbs. The blood flow is sufficient and the incidence of infection is low. It is suitable for the patients with short-term intravenous chemotherapy and peripheral vein too thin to use PICC.

PICC

The utility model uses a new polyurethane catheter to puncture and intubate from the coarse vein (noble vein, median elbow vein and cephalic vein) of the elbow. The first choice is the noble vein, the second choice is the middle vein and the head vein. The length of the catheter was 40-45cm, reaching the superior vena cava. The results showed that the blood flow of peripheral vein and superior vena cava was 1 ml / min and 2 500 ml / min respectively. The injection of drugs into the blood is diluted rapidly, which relieves the damage of drugs to the peripheral blood vessels, protects the vascular network of the upper limbs, relieves the pain caused by repeated puncture and intravenous injection of high stimulation drugs, and ensures the smooth implementation of intravenous drug treatment and the supply of nutrients.

TIAP (CVPAS)

It is also called completely implanted central venous catheter system (cvpas) (tivap), which is called infusion port for short. In 1982, the method of surgical technology implantation through the cephalic vein in the infusion port was first reported by niederhuber, Anderson Cancer Center, University of Texas, USA. It is a kind of intravenous infusion device which can be implanted subcutaneously and kept in the body for a long time. It is mainly composed of injection base and venous catheter, and can be used for infusion of various drugs, replenishment of liquid, nutritional support, blood transfusion, blood sample collection, etc. This method can avoid repeated puncture, at the same time, the drug can be directly transported to the central vein, to prevent the injury of peripheral vein caused by stimulant drugs, and can be used as a permanent pathway for patients. The safety, infection rate and patients' acceptance of PICC were better than those of PICC. This technology not only solves the problem that the

common deep vein catheter can not be retained for a long time, but also solves the problem that the peripheral vein infusion has a great impact on the daily activities of patients. The patients' life is not limited and the quality of life is greatly improved.

The implantation process of intravenous infusion therapy device

It is mainly arranged by surgeons in the operating room according to the requirements of the operation, and the arm vein infusion port can also be implanted by qualified professional nurses under the guidance of doctors. At present, there are two main methods of tivap implantation: one is blind puncture of blood vessels according to the anatomical location of the body surface; the other is deep vein puncture under the guidance of color Doppler ultrasound. After the catheter is placed in a predetermined position, a subcutaneous tunnel is established with a puncture needle, then a bag is made of free subcutaneous fat to hold and fix the base of tivap, and then the catheter is connected with the base of the infusion port. After the return of blood is successful, pulse injection of 10ml heparin salt water is used to check whether there is leakage or not, and then suture and fix the catheter. Finally, the injection base is connected with a butterfly wing needle through percutaneous puncture To establish the vein therapy pathway. X-ray should be taken to confirm the position of the catheter after the operation.

People oriented thinking method of medical device design

Among the many design thinking methods, there are diamond model of British design association or people-oriented design idea of IDEO, design thinking process of Stanford d.school, Google design, interaction design, etc.

No matter what design method we choose, we can not deviate from the five people-oriented design principles:

1. Develop a people-centered design plan;
2. Understand and specify the use status;
3. Determine the actual goal;
4. Produce the design plan according to the design goal of people-oriented;
5. Evaluate the design according to the design goal of people-oriented.

Don Norman (vice president of Apple's advanced technology team and professor of the University of California, San Diego) shared a similar view. He believed that everyone knows what they need. If they have the tools and knowledge to create, they don't need other hands. People can create what they need most. So the mission of designers should be to let everyone create freely. So it is important to depend on each other in the process of human centered design.

All design is redesign.

Therefore, no matter any design method is used, the basic point of "people-oriented" should run through the whole design process. In view of the intravenous infusion treatment device is now a finished product and has completed a lot of basic steps, so in this paper, we pay more attention to feedback and redesign these two links. In this step, to constantly reflect the needs of users, we must constantly evaluate the redesign, eliminate the adverse factors, and timely modify the redesign according to the evaluation information.

Patients' feedback is the source of information for evaluation. Combined with effective patient information, repeated debugging of product design is an effective way to improve the design. This method can eliminate the factors that do not conform to the patients in the design process as early as possible, so as to ensure the reliability of the design.

In human centered design, feedback and evaluation are the basic steps, which should run through all stages of the system life cycle. At the early stage of the design process, the focus should be on obtaining feedback that can be used to guide the design; at the later stage, when the product is mature, the feedback can measure whether it meets other requirements of the patient better.

The evaluation plan shall include the following aspects:

(1) The goal of redesign;

(2) Personnel arrangement for evaluation;

(3) The arrangement of evaluation system, such as the object of collection, tracking method, number of patients and medical care, model;

(4) The process of evaluation and implementation;

(5) Evaluation and analysis methods of test results;

(6) Evaluate the project schedule and its relationship with the

redesign project schedule;

(7) Feedback and use results on other design projects.

Due to the differences in the implementation of assessment environment, assessment technology is different in its formality, strictness and user participation. The decision-making depends on the constraints of practice and funds, the stages in the development life cycle and the nature of the system to be developed.

Establish feedback mechanism:

The human centered design principle requires evaluation at all stages of the design process to promote product improvement. This requires the feedback system of design information to be established in the design process, so as to timely understand the suggestions and problems of patients and medical staff.

The feedback information shall show the following aspects:

(1) User feedback - patient satisfaction;

(2) To identify and diagnose potential problems with suggestions on medical device functions, using parts, working environment and scenarios;

(3) Choose the best design scheme in empathy, emotion, function and meeting the needs of users;

(4) Get feedback and deeper needs from patients.

In the early stage of medical device product design, expert evaluation can be completely used, which is a very feasible method. Expert evaluation is very effective for identifying major problems, but it is not enough to ensure a successful interactive system, and some detailed problems may be missed.

Based on the evaluation of patients and medical care, feedback on the design can be provided at any stage of the design.

Due to the further development of the design, the goals evaluated by patients and medical staff are gradually established and completed on a more specific version.

Outcome output index -- factors to be considered in design

Aesthetics of appearance, location of device, satisfaction of life convenience, privacy

Aesthetic factors

In Zhang Jinhong's research progress questionnaire on the satisfaction and quality of life of patients with complete implantable intravenous infusion port, it is concluded that aesthetic factors have been proved to be the main influencing factors on the satisfaction and quality of life of patients, and the different implantation sites also significantly affect the satisfaction and quality of life of patients. Now some patients will choose the peripheral vein of the arm to be implanted into the infusion port. Compared with the subclavian vein and the jugular vein, it is more beautiful, with the advantages of invisibility of scars and shorter subcutaneous tunnel. This operation method is more suitable for patients with high requirements for aesthetics.Other studies have shown similar results with patients reporting good overall satisfaction while complaining about cosmetic issues (Lilienberg et al. 1994; Rodgers et al. 1998; Kreis et al. 2007).

Patients who had a low level of satisfaction with the cosmetic result had a significantly lower level of overall satisfaction. （S.N. NAGELR）

The cosmetic result is assessed subjectively from the patient's perspective, and personal perception is critical to satisfaction. In contrast, the occurrence of complications and the persistence of pain were expected to have a strong impact on satisfaction, but these did not explain the degree of variance after statistical testing. In different studies, a body image change was found to play a significant role in patients' adjustment during the course of treatment. This result is in line with former findings, showing the often neglected importance of body image as part of the image of oneself inthe process of coping with the fact that one's body is changed in a not only medical but also aesthetic dimension. Feeling good about one's appearance remains an important aspect of life even when coping with an illness, as shown by the significant influence of satisfaction with the cosmetic result on overall satisfaction with life.

Location of device

In 2014 and 2017, Mary conducted two surveys on acceptance and satisfaction

of the infusion port, especially in terms of aesthetic effect, private life and daily or professional activities of young and old people. For tumor location, when it comes to breast surgery, nearly 30% of patients' body image self-perception is not satisfactory, so breast cancer patients are the least satisfied with aesthetic effect and private life. It seems that the location of implanted blood vessels has a certain impact on daily life, among which the right infusion port has a significant impact on patients' satisfaction and acceptance. Secondly, women's satisfaction scores were lower than men's, the results showed that when the infusion port was implanted, aesthetic factors had a significant impact on patient satisfaction, and was a predictor of quality of life.

Privacy

At the same time, during the infusion treatment, the first infusion post infusion, especially for female patients, can avoid the embarrassment and discomfort caused by exposing the chest. Li et al. Found that after implantation of peripheral, subclavian and jugular vein, there was a significant difference in the visual attention and sleep effect between the peripheral arm vein group and the jugular vein group. Patients in the arm peripheral vein group had higher postoperative satisfaction and quality of life.

Quality of life

Goltz study also showed that the satisfaction and quality of life of patients in the arm peripheral vein group were significantly better than those in the subclavian and jugular vein groups. In addition, Goltz mentioned that patients with the base of the infusion port placed on the front chest wall often feel uncomfortable when wearing a bra, driving a vehicle to use a seat belt or being used to leaning over to sleep. Therefore, patients should be informed in advance when choosing the operation site. If there is no contraindication, it is a better choice to implant the infusion port in the arm position. In addition, the incidence of complications after the infusion port implantation also affects the satisfaction and quality of life of the patients in the infusion port. Some patients are worried about the complications such as the rupture of the base of the infusion port, the blockage of the catheter in the infusion port,

infection and thrombosis.

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Zhang yanru et al. Analyzed the influence of the infusion port on the quality of life of 120 lymphoma patients. The questionnaire used the quality of life scale of chemotherapy and biotherapy for cancer patients, covering five aspects of physiology, spirit, psychology, society and overall subjective feeling. The results showed that social response, disease situation, treatment mode and economy would affect the quality of life of lymphoma patients. In addition, the study also compared the two ways of infusion port and peripherally inserted central venous catheter, and found that chemotherapy with infusion port can delay patients' quality of life compared with peripherally inserted central venous catheter.

DISCUSS

In the various questionnaires fed back above, we can see that the items of appearance aesthetics, location, convenience of life and privacy have a high proportion in the hearts of cancer patients. Although the biggest function of intravenous infusion therapy device is to help patients recover health, in patients' mind, the above items can more dominate patients' satisfaction with the use of this medical device.The cosmetic result of the implantation procedure should not be underestimated, because it is statistically proved as a predictor for satisfaction and quality of life.

From the development of this medical device, a product with 20 years of practical experience still has a long development in its design. The root is that there is still more room for improvement of this product to achieve people-oriented design.

In this case, we can give relevant medical device designers and engineers an inspiration. Can we give patients a better experience in the design of the main body, the design of the catheter, the design of the implant location, and

the design of more relevant details? For example, the optional size and material of the catheter; the size and height of the base are reduced to a lower level, making the appearance of the patient more aesthetic. Whether the pressure in life refers to the ability to bear higher pressure; in emergency treatment, the flow rate is larger; the mass is lighter, the puncture diaphragm is larger; and better materials are selected to form better biocompatibility, resulting in lower body foreign body feeling of patients after implantation.

RESULT

People oriented is an important factor that patients pay attention to in the design of intravenous infusion treatment device. The humanized design of intravenous infusion treatment device is not only the design of technical performance, but also the design of its appearance and shape. It should not only be convenient for operation, with clear interface, but also hope that it can give patients a good feeling, especially in the design of cancer patients, in addition to satisfying In addition to safety, it should also be used from the time, such as general product modeling aesthetic principles, structural design principles and other factors, especially to meet the requirements of humanization and other aspects.

First of all, the modeling design of intravenous infusion treatment device must consider the psychological impact of people. In the application scenario, the discovery of early cancer has a great impact on the psychological impact of medical staff and patients. In addition, its invasive modeling shape will increase the anxiety and fear of medical staff and patients. If in the design of invasive medical devices, the product appears soft and friendly, which will give the medical staff and patients a sense of psychological security; for example, when the infusion treatment device is hidden, the infusion parts should be hidden as much as possible according to the patient's choice will and under the function of satisfying the infusion, and the parts that cannot be hidden can be made through other aspects It can produce enough sense of security for medical staff and patients.

Secondly, the integration of patients and medical staff with intravenous infusion therapy device can also relieve the psychological pressure of medical

staff and patients. During the treatment of different cancer patients, medical staff are likely to encounter an emergency every moment. In this situation, medical staff may make human errors due to the intravenous infusion treatment device, resulting in irreparable consequences, even human life. Therefore, when designing the intravenous infusion treatment device, we should also consider the possibility of various emergency situations, such as catheter flow rate and the difficulty of main body puncture,. From the perspective of doctors' first aid and patients' assistance, we can get more psychological support from users of both sides.

Moreover, the shape and material are also important factors in the design of intravenous infusion treatment device. In the face of cancer, the choice of intravenous infusion treatment device is one of the most important parts of their treatment plan. The display of the device (the shape of the main body, the thickness of the catheter, the choice of the material), and the use of other patients (such as the shape of the device on the surface of the skin after entering the body), can eliminate the patients' rejection and fear of the medical devices, so that the patients can get more intimate psychological feelings of treatment. We should pay full attention to the shape and appearance display, understand the influence of the shape on the intravenous infusion treatment device, and finally understand the influence of the product on people, and strive to combine the shape and size with the product design scientifically and organically, so as to maximize the function and role of the intravenous infusion treatment device.

Therefore, the modeling design of the intravenous infusion treatment device should comprehensively consider many factors such as material, shape, operation friendliness, etc., pay attention to people's spiritual and emotional feelings, focus on the relationship between medical staff and patients, explore the demand motivation and demand psychology of different groups, alleviate the psychological pressure of medical staff and patients from the shape, and create the ability to It is an intravenous infusion treatment device that can meet the material and spiritual needs of doctors and patients.