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Design and development of novel patient garments: A review paper

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Abstract

This study aims to identify important features for use in patient garments by reviewing previous studies and attempts to improve garments. Understanding the shortcoming and recommendations of the previous studies will help in improving the results and form the basis for future studies. Thus, this paper helps to understand key features for designing a garment with design features to eliminate the problems of the end users and also for large scale adoption among masses.

Keywords: Patient Garments, Patient Gowns, Patient Pajamas

1. Introduction

According to the World Health Organization, health is “a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity”. Unfortunately, no human being can claim to be able to stay healthy all his life, and everyone needs medical attention at some point of his or her life. When people become very sick, they often require admission to hospitals.

In the ancient times, most sick people were nursed at their homes. While it is difficult to fathom when hospitals first came into being, it is known that the evolution of hospitals in the Western world from charitable guesthouses to centers of scientific excellence has been influenced by a number of social and cultural developments. These influences have included the changing meanings of disease, economics, geographic location, religion and ethnicity, the socioeconomic status of clients, scientific and technological growth, and the perceived needs of populations (Risse1999) [4]. Again, there is little literature available about when patients in hospitals started wearing specific garments. The Wall Street Journal reported that medical historians think the modern day gowns evolved from nightshirts patients wore in hospitals in the 1800s (Amandolare 2009) [11].

Patient garments are provided by the caretakers to patients with the object of ensuring the ease of identification, access for examination by doctors and nurses, comfort for the patients, and protection from the infection that may be caused by patient's own clothes. The most commonly used patient garments are the patient gowns and pajamas (Iltanen, Topo 2007) [5]. On visiting various Indian government and private hospitals, it was found that hospitals in India use mainly two types of garments i.e. gowns that open in the back and a pajama with kurta or kimono top. Various attempts have been made by international researchers in designing and developing improved patient garments. But large scale adoption of the new designs has not been found. To design and develop patient garments which can be accepted universally and have practical implications, a detailed study of the previous attempts and researched needs to be done. Understanding the shortcoming and recommendations of the previous studies will help in improving the results and form the basis for a new study.

2. Previous Studies and Inventions

Only few studies have focused on developing universal garments for patients with different ailments, with most studies focusing on development of one garment for one specific ailment. Cho *et al.* (2006) [2] invented and patented a gown design called papilla gown which can be comfortably worn by a patient who needs to use a drainage system after a surgery, especially a breast surgery. In this gown design, cloth web is included which can be adapted to cover the

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body of a patient. An elongated hole is provided on the cloth web communicating the inside of the cloth web with the outside of the cloth web. A pocket is attached to the cloth web, a cover portion that is provided on the outside of the cloth web and covers the hole, and a fastener that fastens the cover portion to the outside of the cloth web. The cover portion is an elongated strip that is pivotally attached to the outside of the cloth web. The hole is aligned with the breast nipple of a wearer and the pocket. The hole, the containing portion and the cover portion are positioned toward the left side or the right side of the cloth web or both. The gown was tried on 13 postmastectomy patients and their feedback was taken. The inventor has claimed that the gown will have various advantages over the traditional gowns. The new design will suitably hold and route a drainage system that is required to be worn after breast surgery, facilitate wearing of drainage system, and fulfill the purpose of good aesthetic appearance. Besides, the design of the cover portion and the fastener will prevent the tube and reservoir in the pocket from being pulled, while also ensuring privacy of a patient by tightly covering the hole through which the tube passes, and hiding the tube and reservoir in the pocket.

Trouillot (2006) invented a hospital gown having strategically positioned slits and fitted fasteners along the front, back and sides to allow preferential closing of the open seams and securing sensor connected leads or intravenous tubing to the patient. The hospital gown was a rear-opened garment, with fasteners for closing the shoulder and sleeves sections, rear fasteners, plurality of strategically positioned slits for passing tubes and wire, and plurality of pockets. The inventor gave an option for a side-opened garment as well. The preferred and alternative embodiments of the hospital gown featured one or more hook-and-loop strips or snaps strategically placed at the front, sides and, or back of the hospital gown. According to the inventor, this garment would provide comfort, privacy and better access to the caregivers.

Park, Ryou (2008) [7] attempted to develop functional pants for the hospitalized bed-ridden patient⁷. This study consisted of three parts. First, an interview survey of the nursing care givers was conducted to inquire into the conditions of bed-ridden patients' clothing. Second, bed-ridden patients' pants design and sample making were accomplished. Then, the wearing tests and design development were completed. The authors emphasized on incorporating a partial opening for diaper change and medical treatment, and provision for ventilation for bedsore prevention. The design developed for the patients' pants had the side seams into two way opening zippers, the wraparound pattern of abdomen, and the opening under crotch applied using the Korean traditional underwear *sukkot*. The wearing tests of the samples were performed three times on hospitalized bed-ridden patients.

One of the first hospitals to introduce a major in the change the design of its patient gowns was Cleveland Clinic. The CEO of the hospital heard many patients complain about hospital gowns, and teamed up with fashion designer Diane von Furstenberg to come up with a better patient gown. The new and improved hospital gown was launched in 2010. The full body garment was reversible, with a V-neck on each side, and full coverage in the front and back. Made of soft fabric, the gown also had bold print patterns and pockets. The results suggest that most patients felt more comfortable wearing the new gowns.

Park J. *et al.* (2012) [8], conducted a study on developing a patient gown for spinal surgery patients, focusing on female patients. The purpose of this study was to develop a

comfortable patient gown for spinal surgery patients. The results of the survey confirmed inconveniences and problems with the existing gown, and a new gown style was recommended. The recommended changes addressed design, pattern, and materials. The final experimental design suggested for the top of the new patient garment was a wrap style that moved the center opening of the gown to the side, and enabled patients to control the length of the sleeves by attaching two snaps. The cutting line was aligned with the back brace location, and the issue of repeated bunching of the gown material by the brace was solved by substituting 100% knitted structure fiber. When lifting up the gown for treatment on specific areas of the body, it allowed for doctors to open the edge of the right side of the gown in order to lift up the top. The bottom of the new patient gown was made from 100% cotton knitted structure fiber, and it enabled patients to control the length of pants by attaching two snaps on the side. The results of an on-site dressing suitability evaluation and a flexibility evaluation with respect to dressing/undressing indicated that the new patient gown was much better received than the existing gowns.

The Henry Ford Health System in Detroit also improved its hospital gowns. Students at the nearby College of Creative Studies were asked to identify a big hospital problem and present a solution. The students chose uncomfortable hospital gowns and suggested a more patient-friendly design. It took the hospital's innovation institute more than three years to design a new, warmer gown which is made of a cotton blend that wraps around patients' bodies, similar to a bathrobe. The gown is named Model G and was developed in navy and light blue color and was introduced in 2013. It is a type of wrap-around robe that blends style and comfort for the patient with essential features needed for doctors, nurses, x-ray technicians, and other hospital staff to provide care. It uses a series of size-adjusted plastic snaps, instead of cloth ties. Patient satisfaction scores were reported to increase within a few days of introduction of the new gown. In a series of clinical trials performed at Henry Ford Hospitals, patient's satisfaction level was found to be increased. More than 35,000 of the gowns were rolled out for use in various clinical units throughout Henry Ford Health System. Designers and engineers from both Henry Ford Health System and Medline are now working on final details including fabric standards and sizing options. Efforts are being made to make the gowns available to hospitals and medical centers.

McDonald *et al.* (2014) [10], in their study on inpatient attire, raised concern about the absence of a lower-body garment that affected patients' dignity by unnecessarily exposing their private parts. They sought to determine what proportions of the patients were actually wearing lower-body clothing. A record was made of the proportion of patients wearing any substantial lower body garment (underwear/ diaper not included), during rounds for all patients admitted on the same calendar day to 6 clinical teaching units at 5 hospitals. The eligibility of individual patients to wear lower-body attire was determined by the attending physicians of those services. At one center, eligible patients were asked whether they would want to wear such attire, and if not, why. Statistical comparisons were performed using the χ^2 test. The results of the study demonstrated that most of the patients admitted to the concerned acute medical units do not wear lower-body attire. This situation occurs despite more than half of them being deemed eligible to do so, and despite most of those patients surveyed being interested in doing so. The authors suggested that, to improve the patient experience, eligible

patients should be encouraged to wear lower-body garments when full home attire is not feasible.

JHA (2009) ^[6] conducted a research entitled 'Exploring Design Requirements for a Functional Patient Garment: Hospital Caregivers' Perspective', in which an investigation was carried out to understand the requirements of a patient gown from the perspective of hospital caregivers. The results of the investigation concluded that the caregivers strongly agreed that there is a need to redesign the traditional patient gown to incorporate the caregiver's need of accessibility and functionality. The study reported that, according to the caregivers, there is a strong connection between the gown and a patient's emotional and physical wellbeing. Also, the caregivers recommended multiple design alternatives. They suggested that the gown should have slits in addition to the pockets. These slits could be used for inserting tubes. Also, an option of both open front and open back, i.e. a reversible gown, would enhance the flexibility of the gown. Another design consideration was to have a "detachable bib" which would reduce the need for constant donning and doffing. It emphasized the importance of having anti-bacterial coating on the gown in order to prevent infection. The researcher suggested that the prototype development phase should therefore focus on implementing an optimal set of requirements which incorporate the needs of the caregivers without compromising the needs of the patients and the hospital administrators. Since adding any new feature in the design may increase cost, a need for cost effective design strategy was recommended.

3. Inferences from the above studies:

The above studies suggest addition of few features in the patient garments. Though different studies suggest different design features, some are common in most studies and are mentioned below:

1. Pockets/ pouches for carrying medical devices
2. Use of lower garment along with upper garment for better patient dignity and comfort
3. Pants with partial opening for diaper change and medical treatment
4. Use of snaps along sides for adjusting length of sleeves and lower garment
5. Opening along shoulder and sleeve of upper garment and along the outer side of the lower garment
6. Wrap style of upper garment with preferably V-neckline and front opening has been suggested in few studies
7. Use of plastic snaps instead of ties for ease of opening and closing
8. Slits or openings for inserting tubes
9. A detachable bib to reduce the need for constant donning and doffing
10. Anti-bacterial coating on the gown for reducing growth of bacteria

4. Conclusion

Studies have suggested that the currently used patient garments in most of the hospitals do not provide enough coverage, easy access for caregivers, easy of movement for the patients and hence are not appropriate for the patients. Changes in design and addition of some features in the garments will improve the patient's experience. One of the studies by (Park *et al.*2012) ^[8], also suggested use of 100% cotton knitted fabric to avoid problem of fabric bunching and thus pressure sore. However to use a 100% cotton knitted fabric will require different laundry conditions and procedures

for disinfection. Besides, having additional features and special finishes on fabrics may increase cost. Hence for larger acceptability, it has been suggested in a study by (Jha 2009) ^[6] to have an effective design strategy which should incorporate essential design features. There is need for a design that will improve function and aesthetics within the cost constraints. The study also suggested for a design that will incorporate all the needs of the patients as well as the caregivers and handling staff. Also, having different designs for different ailments and different colors of fabric for different sizes will add to the cost of production and maintenance. The solution for better acceptance is one universal design for all ailments with identification of essential features to overcome problems of all the end users.

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