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RESEARCH ARTICLE

INNOVATIVE NURSING PRODUCTS DEVELOPED BY NURSING TEACHERS AND STUDENTS IN TAIWAN

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ABSTRACT

Taiwan's Minister of Education encourages industry–school cooperation for developing innovative products; therefore, in 2011, the author developed a nursing practicum project course in which nursing faculty and students can develop innovative nursing products. The present study developed five innovative nursing products for solving various clinical problems experienced by patients. The structures and functions of these products are presented with design illustrations and model photographs. The approved patents for these products are reported. These nursing products are expected to serve as nursing intervention tools to improve the quality of care for patients by solving different types of clinical problems.

INTRODUCTION

Since Taiwan's Minister of Education strongly emphasized creative education (Minister of Education, 2004), numerous technical colleges and universities have started offering creative courses for increasing the number of opportunities for industry–school cooperative projects that study innovative products and applied patents. Therefore, the author developed a nursing practicum project course in 2011. In this course, nursing faculty and students develop innovative nursing products. Between 2011 and 2015, the author guided nursing teachers and students to develop numerous innovative nursing products with approved patents in Taiwan. This study introduces five innovative nursing products for solving clinical problems experienced by patients. The structures and functions of these products are illustrated with design pictures and model photographs. Finally, the approved patents of these products are shown.

METHODS AND MATERIALS

The innovative nursing products were developed in five steps. The nursing faculty first led a group of nursing students to discuss the most remarkable clinical predicaments. Second, the nursing students participated in a brain-storming session to conceptualize different types of innovative nursing products to solve the clinical problems of patients. Third, the faculty guided the students to analyze and compare the strengths and limitations of all nursing products through academic literature reviews and internet searches, and assisted them in making their final decisions for developing their innovative nursing products. Fourth, after the nursing faculty and students created their innovative nursing products, the principal faculty member contacted a patent company to discuss the possibility of patenting the products. Finally, the nursing faculty assisted the nursing students in applying for patents with the school system, and on approval, the patent company prepared the patent application documents for the approved innovative nursing products. Furthermore, some innovative nursing products were developed as model cases for future technological transformations of the medical device industry.

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RESULTS

The following five innovative nursing products were approved in our team:

A Nasogastric Feeding (NG) device for fixation and electronic stirring, a device to assist breathing exercises, a device for tube fixation, a device for NG tubes, and a device to drain sputum from the trachea.

Product Number One: NG Feeding Equipment for Fixation and Electronic Stirring

The NG feeding equipment for fixation and electronic stirring is composed of a feeding tube with two projections at the barrel of a syringe, which linked with two notches of the NG soft covering. Moreover, the top of the feeding tube is connected to an electronic, motorized mixing device that integrates the first projection with the second. The electric mixing device includes a circuit board with a rotary projection. The board supplies the required power to rotate the rotary projection. The motion of the rotary projection drives a stirring rod. Figures 1, 2, 3, and 4 show the designs and models of the NG feeding equipment for fixation and electronic stirring (patent numbers M504598 and M506605 of ROC).

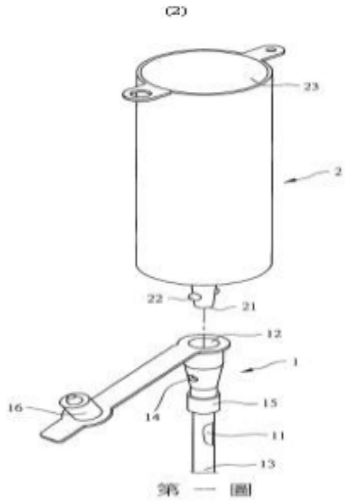

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Figure 1. Design of NG feeding equipment for fixation

Product Number Two: A Device to Assist Breathing Exercises

A device to assist breathing exercises can enable patients with breathing-related illnesses to perform the chewing-mouth-formula breathing exercise. This exercise is divided into two parts: two deep inhalations, and one period of chewing-mouth-formula breathing. The assisting components include one mask with an up (inhalation) area connecting a nasal cannula with a portable oxygen tank providing 100% O_2 and a down (exhalation) area connecting a round tube to disperse CO_2. When the patients do not practice the chewing-mouth-formula breathing exercise daily, we might use an activated carbon piston with a hole that lets CO_2 out of the piston but does not allow it to return to the mask. The chewing mouth formula is a self-paced health-promoting breathing exercise involving breathing in twice and breathing out once, which can increase O_2 and reduce CO_2 in the lung, thus releasing dyspnea symptoms. Figures 5–8 show the design of the device, and models of relevant components and of the device (patent number M526896 of ROC).

Product Number Three: The Device for Tube Fixation

This product was developed to prevent catheter slippage in patients with artificial tubes. Catheter slippage can cause serious complications, such as immediate threats to patient life. The principal component of this product is a one-way valve, which can prevent any forward and backward movements of an electrode patch fixed on a patient's skin. The tube fixation device can be attached to any part of a patient's body to prevent catheter slippage. Figures 9 and 10 show the design and model of the tube fixation device (patent number M526876 of ROC).

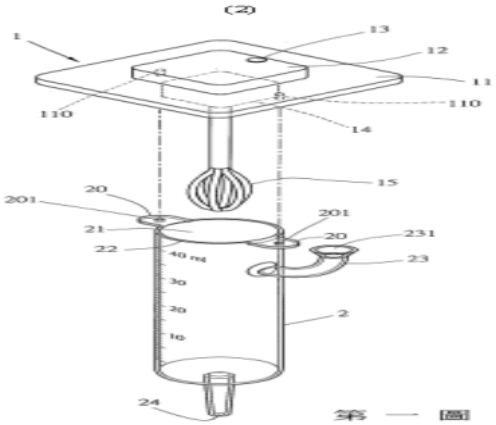

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Figure 2. Design of NG feeding equipment for electronic stirring

Figures 3 . Model of NG feeding equipment for electronic stirring

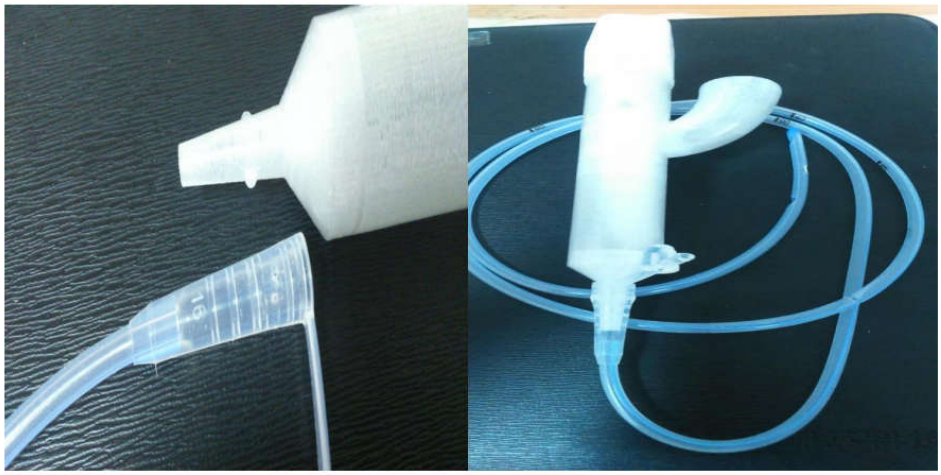


Figure 4. Model of NG feeding equipment for fixation

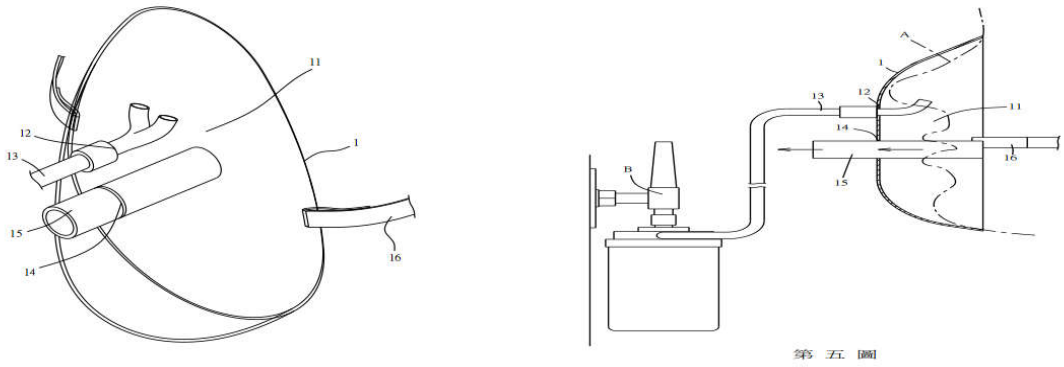


Figure 6: 第 一 圖 Design of the device to assist breathing exercises

Figure 7. Model of a tube and an activated carbon type piston

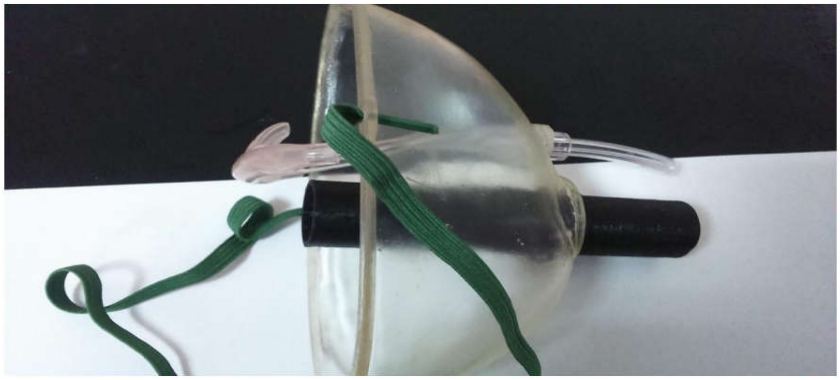
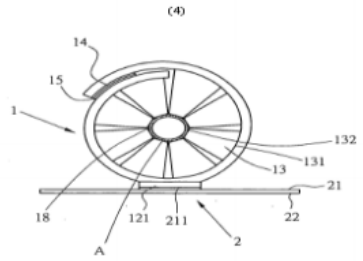


Figure 8. Model of the device to assist breathing exercises



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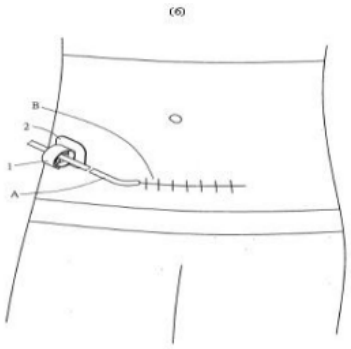

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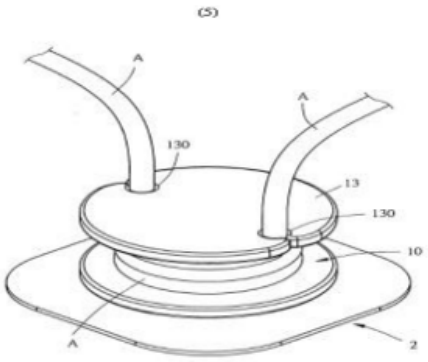
Figure 9. Design of the tube fixation device

Figure 10. Model of the tube fixation device



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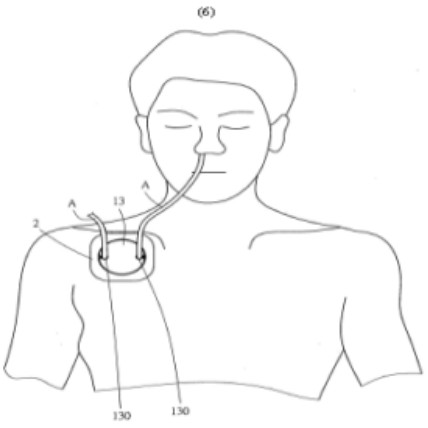

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Figure 11. Design of the assisting components of the NG tube

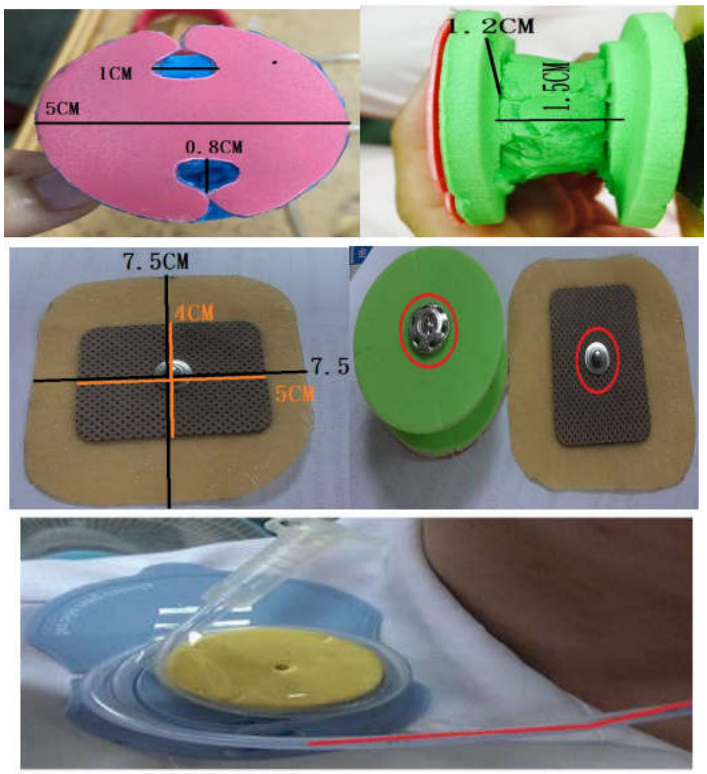

Figure 12. Model of the assisting components of the NG tube

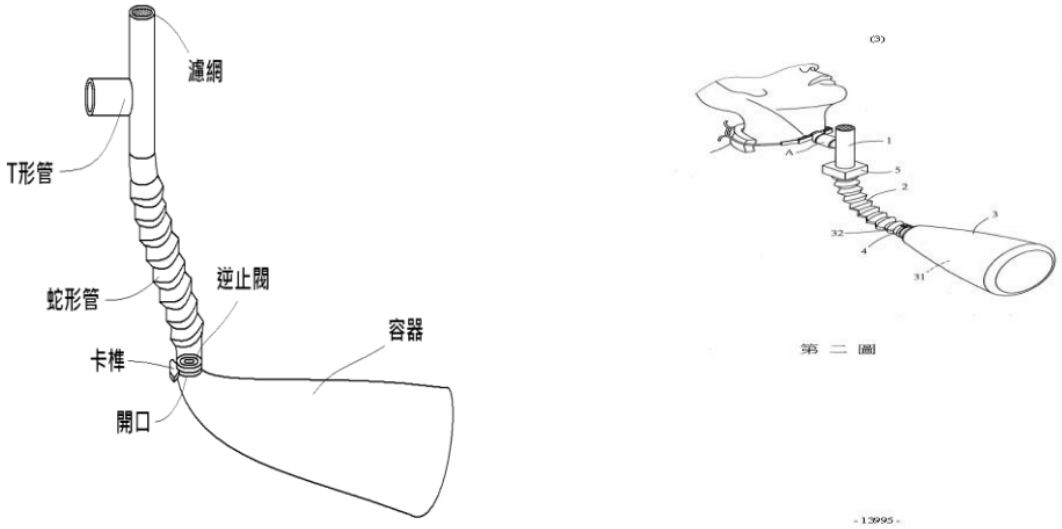

Figure 13. Design of the assisting components of sputum drainage of the trachea

Figure 14. Model of the assisting components of sputum drainage of the trachea

Product Number Four: A Device to Assist NG Tube Fixation

The product facilitates NG tube fixation. This assisting component is an artificial tube with the function of coiled tube storage; that is to say, tubes can be coiled up and stored inside this component to prevent NG tubes from slipping out, or getting pulled out, of the patient's nose. This component can attach the skin of the patient to an NG tube; after the patient has been fed, the NG lines can be coiled up and stored inside the product. Figures 10 and 11 show the design and model of this NG tube accessory (patent number M526897 of ROC).

Product Number Five: A Device to Drain Sputum from the Trachea

Patients with tracheal tubes often encounter sputum spillage when they cough. This innovative product drains sputum from the trachea. The T tube has a filter on one side, and the other side connects to a serpentine tube with a one-way valve that prevents the sputum from re-entering the T tube; a bag (secured by a latch) collects the sputum. When the bag is sufficiently full of sputum, nurses can open the latch and change the bag. Figures 12 and 13 show the design and model of the device to drain sputum from the trachea (patent number M522739 of ROC).

Conclusion

The study reported five innovative nursing products for solving various clinical problems experienced by patients. Moreover, the structures and functions of these products are demonstrated using design pictures and model photos, with the approved patents. Following the development of these products, the research team started negotiating with companies to begin cooperative efforts to commercialize these technological designs. Furthermore, these products are expected serve as nursing intervention tools to improve the quality of care for patients by solving their diverse clinical problems. In particular, evidence-based nursing products can be developed in future studies; clinical trials can obtain evidence regarding the products. Evidence-based medical technology can be applied to developing novel medicines and treatments. Nursing professionals can use new avenues for conducting evidence-based studies focused on innovative nursing products. Finally, the five products mentioned in this study can serve as a reference for other nursing teachers who are interested in innovative teaching, research, and practice.

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