DOI: https://doi.org/10.36489/saudecoletiva.2020v10i54p2719-2728

Safety device for ventilatory assistance: Conectony - minimizing risks in the COVID-19 context

Dispositivo de seguridad para la asistencia ventiladora: Conectonía: minimización de riesgos en el contexto de COVID-19

Dispositivo de segurança para assistência ventilatória: Conectony - minimizando riscos no contexto COVID-19

ABSTRACT
Objective: To present the experience report of the collaborative action that made possible, based on the idea of innovation proposed by the author, the making of CONECTONY. This is a safety device consisting of two connectors interconnected by a segment of flexible tube that aims to extend the tracheostomy cannula and enable clamping with a strong clamp, allowing to meet the recommendations of the main healthcare companies, national and international, regarding the manipulation of the advanced airway in patients affected by COVID-19. Methodology: Descriptive study like an experience report based on the Design thinking process. Experience Report: Based on the technical specifications and measures provided by the author, a professor of Metallurgical and Materials Engineering carried out the construction of the technical design of the parts for printing in 3D format. The 3D printed prototype demonstrated perfect adaptability to the tracheostomy cannula and to the ventilatory assistance connectors and circuits. Final considerations: Incorporating the use of the CONECTONY device into healthcare practice and nursing care for tracheostomized patients, has the potential to provide greater safety to health professionals, minimizing the risk of contamination by COVID-19
DESCRIPTORS: Coronavirus Infections; Respiration Artificial; Diffusion of Innovation; Critical Care; Nursing Care.

RESUMEN
Objetivo: Presentar el informe de experiencia de la acción colaborativa que hizo posible, en base a la idea de innovación propuesta por el autor, la realización de CONECTONY. Este es un dispositivo de seguridad compuesto por dos conectores interconectados por un segmento de tubo flexible que tiene como objetivo extender la cánula de traqueotomía y permitir la sujeción con una abrazadera fuerte, lo que permite cumplir con las recomendaciones de las principales compañías de atención médica, nacional e internacional, sobre la manipulación de la vía aérea avanzada en pacientes afectados por COVID-19. Metodología: estudio descriptivo como un informe de experiencia basado en el proceso de pensamiento de diseño. Informe de experiencia: Basado en las especificaciones y medidas técnicas proporcionadas por el autor, un profesor de Ingeniería Metalúrgica y de Materiales llevó a cabo la construcción del dibujo técnico de las piezas para imprimir en formato 3D. El prototipo impreso en 3D demostró una adaptabilidad perfecta a la cánula de traqueotomía y a los conectores y circuitos de asistencia ventilatoria. Consideraciones finales: la incorporación del uso del dispositivo CONECTONY en la práctica de atención médica y la atención de enfermería para pacientes traqueostomizados, tiene el potencial de proporcionar mayor seguridad a los profesionales de la salud, minimizando el riesgo de contaminación por COVID-19
DESCRIPTORES: Infecciones por Coronavirus; Respiración Artificial; Difusión de Innovaciones, Cuidados Críticos; Atención de Enfermería.

RESUMO
Objetivo: Apresentar o relato de experiência da ação colaborativa que possibilitou, a partir da ideia de inovação proposta pelo autor, a confecção do CONECTONY. Este trata-se de um dispositivo de segurança composto por dois conectores interligados por um segmento de tubo flexível que tem por objetivo prolongar a cânula de traqueostomia e possibilitar o clampeamento com uma pinça forte, permitindo atender as recomendações das principais sociedades de assistência à saúde, nacionais e internacionais, no que diz respeito a manipulação da via aérea avançada nos pacientes acometidos por COVID-19. Metodologia: Estudo descritivo tipo relato de experiência fundamentado no processo de Design thinking. Relato de Experiência: A partir das expecificações técnicas e medidas fornecidas pelo autor, um professor de Engenharia Metalúrgica e de Materiais realizou a constução do desenho técnico das peças para impressão em formato 3D. O protótipo impresso em 3D demonstrou perfeita adaptabilidade à cânula de traqueostomia e aos conectores e circuitos de assistência ventilatória. Considerações finais: Incorporar a utilização do dispositivo CONECTONY à prática assistencial e ao cuidado de Enfermagem aos pacientes traqueostomizados, tem potencial para conferir maior segurança aos profissionais de saúde, minimizando risco de contaminação por COVID-19.
DESCRITORES: Infecções por Coronavirus; Respiração Artificial; Difusão de Inovações; Cuidados Críticos; Cuidados de Enfermagem.

RECEIVED ON: 05/02/2020 **APPROVED ON:** 05/05/2020

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INTRODUCTION

Before the COVID-19 pandemic, five coronaviruses were already known to infect humans, including SARS-CoV, responsible for the global outbreak in 2003. Coronaviruses are particularly pathogenic in humans and are associated with difficult management, high mortality and serious implications for public health[1].

There is an urgent need to produce studies to substantiate, with scientific evidence, both management, clinical management and care, as well as the production of innovations and technological solutions that can be quickly used to confront COVID-19.

In the context of the coronavirus pandemic, in patients who need an advanced airway for ventilatory assistance, it is recommended that, at the time of orotracheal intubation (IOT), the insertion of the orotracheal tube (TOT) occurs with the same clamped by a strong forceps. The guideline is that this clamp should be used at all times when it is necessary to disconnect the TOT from the mechanical fan. The purpose of this clamping is to prevent aerosolization of viruses in the environment and, consequently, to avoid contamination by health professionals[2-4].

In clinical cases that evolve with difficulty in removing the patient from a ventilatory prosthesis, when there is a need to prolong the time of mechanical ventilation, it may be necessary to make a tracheostomy. Conventional models of tracheostomy cannulas do not allow the recommended clamping, predisposing health professionals to risks both at the time of surgical preparation and in cases of disconnection of the circuit.

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Technological advances are a reality in today's world, acting using technological tools that facilitate work and the optimization of time and resources, incorporating different types of interactivity through the use of technologies, are necessary and essential skills to be learned and continuously applied in work processes[5].

The development of collaborative, interactive and interdisciplinary projects can be facilitated through the use of Communication and Information Technologies (ICT). Interactivity ensures agility to the necessary responses, allowing the establishment of fast, efficient and secure communication mechanisms. One of the possibilities also refers to remote project management, providing planning, development, monitoring and evaluation[6].

In this sense, this study aims to present the experience report of the collaborative action that made possible, based on the idea of innovation proposed by the author, the making of CONECTONY. This is a safety device composed of two connectors interconnected by a flexible tube segment that aims to extend the tracheostomy cannula and enable clamping with a strong clamp, allowing to meet the recommendations of the main healthcare companies, national and international, regarding the manipulation of the advanced airway in patients affected by COVID-19.

We highlight the relevance of this

study both in the description of the collaborative knowledge-building process, as well as in the description of the technological construction of the device itself, which provides care security while minimizing risks to health professionals.

METHODOLOGY

Descriptive study, report type of experience of technological innovation, in which the collaborative process of building a safety device for health care was approached based on the processes and fundamentals of Disign Thinking.

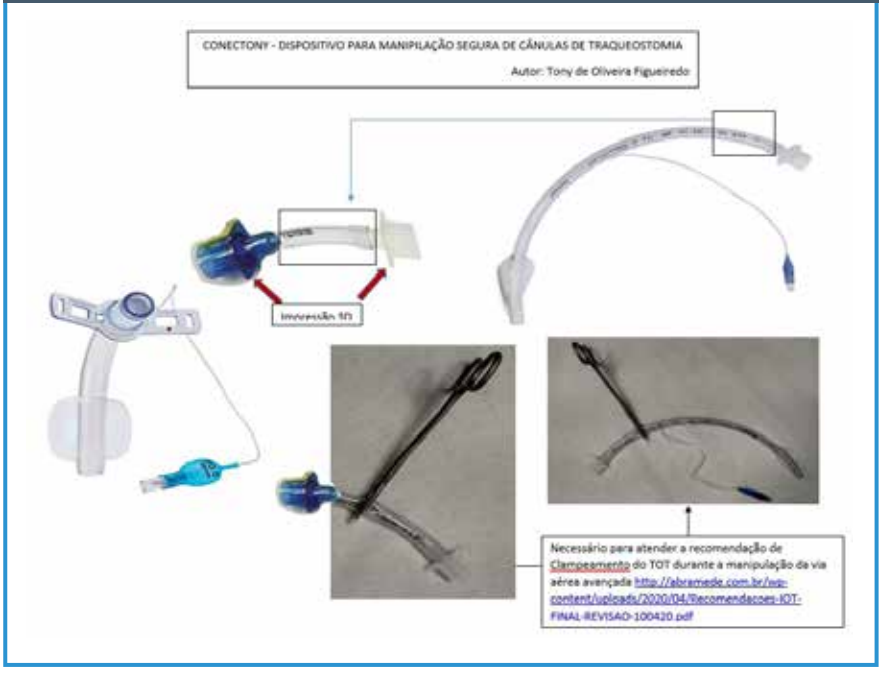
Design Thinking is a practical--creative problem solving method, which has the potential to transform the production of knowledge and solutions. It develops an intentional methodological process to arrive at creative, practical solutions and create positive impacts. The process generally involves five steps: empathize, define, design, prototype and test. Through these, problems are elucidated through dialogue and observation and ideas take shape until they become a solution, which will be put into practice[7].

The technological construction of the CONECTONY device resulted from the ideation report and research documents defined based on the author's professional experience, Nurse with over 25 years of activity in Intensive Care Units and High Complexity, with technical and scientific production in the area.

The empathy with the risk situation of health professionals when caring for patients affected by the COVID-19 pandemic leads to constant reflection on the review of care processes and the use of technologies and was decisive in the idea of improvement.

Plotting the project using images allowed the technical area to fully understand the idea, as well as its relevance. The presentation was built based on images available on the Internet and Microsoft Word® program resources (Figure 1). The author accompanied and consulted at all stages of development and was responsible for testing the functionality of the device.

Figure 1. Plotting the CONECTONY device. Rio de Janeiro, RJ, Brazil, 2020.



The ideation report and the justification for implementing the concept were presented to the technical area via video (available at: https://youtu.be/8EY_ahhjpIE) sent via messages on the Internet/Whatsapp application and discussed on the day April 21, 2020, in the Multidisciplinary Working Group (GT) for Coping with COVID-19 at the Federal University of Rio de Janeiro (UFRJ).

The author explained his intention, in the name of the common good and human life, considering the urgency in producing solutions to cope and prevent COVID-19, to allow the dissemination of the concept, as well as to make the specifications publicly available for printing the device in 3D format. There was guidance by members of the WG regarding the registration of intellectual property by the author, allowing the reproduction of technology, provided that the author / source of development is referenced. On the same day, April 21, 2020, intellectual property was registered on the website https://creativecommons.org/.

EXPERIENCE REPORT

Based on the technical specifications and measures provided by the author, a professor of Metallurgical and Materials Engineering at the Alberto Luiz Coimbra Institute for Postgraduate Studies and Engineering Research, at the Federal University of Rio de Janeiro (COPPE / UFRJ) made the design technical parts for printing in 3D format. On April 22, 2020 the preliminary design of the two connectors that make up the device was presented (Figures 2 and 3) and on April 23, 2020 the parts were printed in 3D format (Figure 4).

Figure 2. Connector 1. Rio de Janeiro, RJ, Brazil, 2020

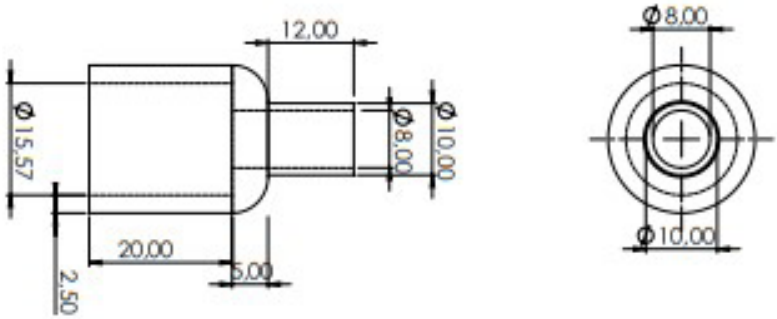


Figure 3. Connector 2. Rio de Janeiro, RJ, Brazil, 2020

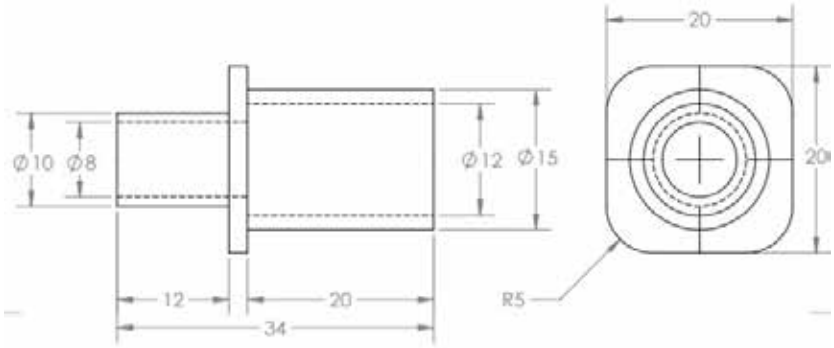


Figure 4. Connectors 1 and 2 printed in 3D. Rio de Janeiro, RJ, Brazil, 2020

On April 24, 2020, the test of the connectors was carried out to check the adaptability and the perfect adaptation of the connector 2 was found, however, it was necessary to review the internal diameter of the connector 1. After the adjustment, it was tested again on the day April 26, 2020, showing perfect adaptation to the tracheostomy cannula, and then the CONECTONY device was assembled (Figure 5).

The later phase, under development, comprises additional tests, description of functionality and definition of protocols with instructions for installation and use in compliance with the determinations and recommendations of the health care agencies and professional societies. Figure 6 demonstrates the applicability in a tracheostomy cannula and also the application in a laryngeal mask, another possibility observed during the applicability tests.

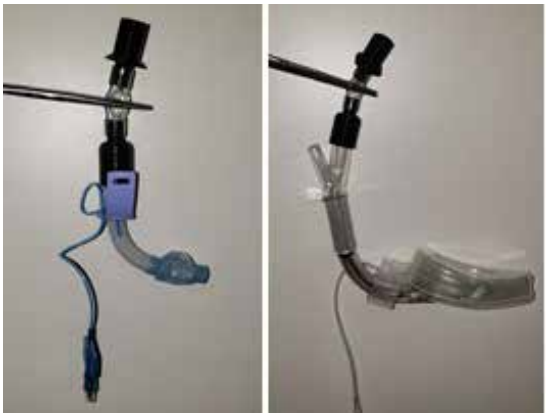
CONCLUSION

This project had the technical collaboration of the Multidisciplinary Working Group (WG) for Coping with COVID-19, instituted in February 2020 by the Rectorate of UFRJ, allowing for the transformation of the concept project into an implementable project in clinical practice and Nursing care.

The realization of the project based on the fundamentals of Disign Thinking and, also, with the support of Information and Communication Technologies to operationalize remote work, consisted of a unique, extremely productive and rewarding experience, as the interdisciplinary integration of ideas, knowledge and knowledge enabled the production of technological innovation in a very short period (only five days), in a timely manner to meet the demand for use in the context of the COVID-19 pandemic.

Figure 5. CONECTONY device. Rio de Janeiro, RJ, Brazil, 2020.

Figure 6. Applicability of the CONECTONY device. Rio de Janeiro, RJ, Brazil, 2020.



The final prototype, printed in 3D, demonstrated perfect adaptability to the tracheostomy cannula and to the other connectors and circuits of ventilatory assistance, constituting an important device in the strategy of minimizing risks of professional exposure, allowing to meet the technical recommendations for clamping the devices. advanced airway in the context of the COVID-19 pandemic.

Incorporating the use of the CONECTONY device into healthcare practice and nursing care for tracheostomized patients has the potential to provide greater safety for health professionals, minimizing the risk of aerosolization contamination of microorganisms in the environment, constituting the indication of its use, which is extremely relevant , even greater at this time of the COVID-19 pandemic.

Possible adjustments may be necessary, both related to the design of the device, as well as the need to review usage processes, which requires the continuity of the study, monitoring and improvement. ■

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