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Device with camera in orotracheal intubation training: possibility of medical education a pandemic period

Dispositivo com câmera para treinamento de intubação orotraqueal: possibilidade de ensino médico em período pandêmico

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ABSTRACT

Introduction: The orotracheal intubation is an important procedure in airway management, especially when performed in emergency situations. Video-laryngoscopy is an artifice that facilitates visualization of the glottis, aiding intubation.

Objective: This study aimed to attach a video camera to a conventional Macintosh-type laryngoscope to enable and train intubation or otracheal training.

Method: The use of a camera coupled to a conventional laryngoscope allows direct and indirect visualization of the glottis. Camera images can be transmitted over wi-fi and shared to electronic devices and platforms, aiming at teaching in person or remotely about orotracheal intubation.

Result: The use of the device as a method of teaching intubation or otracheal, allows teaching to teach the theory of procedure and training the execution performed by the artisanal method. This feedback in the practical training of orotracheal intubation in mannequins can be performed in person or remotely.

Conclusion: The use of handcrafted video laryngoscopy device in medical education is a low-cost tool to improve conventional orotracheal intubation training.

Keywords: Laryngoscopy; Intubation Intratracheal; Teaching; Airway Management; Simulation Training.

RESUMO

Introdução: *A intubação orotraqueal é um procedimento importante no manejo da via aérea, principalmente quando realizada em situações de emergência. A videolaringoscopia é um artifício que facilita a visualização da glote ao auxiliar a intubação.*

Objetivo: *Este estudo teve como objeto acoplar uma câmera de vídeo a um laringoscópio convencional do tipo Macintosh para possibilitar e orientar o treinamento da intubação orotraqueal.*

Método: *O uso de uma câmera acoplada a um laringoscópio convencional permite a visibilização direta e indireta da glote. As imagens da câmera podem ser transmitidas por wi-fi e compartilhadas para dispositivos e plataformas eletrônicos, visando ao ensino presencial ou remoto da intubação orotraqueal.*

Resultado: *A utilização do dispositivo artesanal como método de ensino de intubação orotraqueal permite ao docente ensinar a teoria do procedimento e orientar e corrigir a execução realizada pelo acadêmico. Esse feedback no treinamento prático pode ser realizado presencialmente ou por via remota.*

Conclusão: *O uso do dispositivo artesanal de videolaringoscopia no ensino médico é uma ferramenta de baixo custo para aperfeiçoar o treinamento de intubação orotraqueal convencional.*

Palavras-chave: *Laringoscopia; Intubação Orotraqueal; Ensino; Manuseio das Vias Aéreas; Treinamento com Simulação de Alta Fidelidade.*

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INTRODUCTION

Orotracheal intubation is one of the most important procedures in airway management. It provides adequate oxygenation and ventilation for patients and ensures airway protection[1]. Emergency intubations are more difficult due to factors related to the patient, the operator and the environment. When the three factors are added, intubation becomes a procedure with potential for major complications[2,3]. The COVID-19 pandemic is a good example of this situation. The high transmissibility by droplets and aerosols requires the use of personal protective equipment (PPE), making it difficult to adequately visualize the oropharynx during the orotracheal intubation procedure[4,5].

It is estimated that approximately 3% of patients with COVID-19 will require orotracheal intubation at some point during the course of the disease[6]. In Brazil, a study reports that 4 of 10 patients with indication for hospitalization required a definitive airway with mechanical ventilation[7]. The Brazilian Association of Intensive Medicine (AMIB, *Associação de Medicina Intensiva Brasileira*) recommends the use of a videolaryngoscope to facilitate the intubation technique[4], taking into account the increased difficulty of intubation in COVID-19 patients and the high demand for this procedure.

Recent studies have shown that video-assisted laryngoscopy does not increase the success of orotracheal intubation nor does it reduce complications when compared to conventional laryngoscopy. However, video-assisted laryngoscopy improves the visualization of the glottis and, for less experienced professionals, contributes to greater confidence when performing the procedure[8]. Better visualization helps in the training of less experienced physicians performing orotracheal intubation of manikins. This corroborates the fact that the worse the scenario in the simulations, the greater the efficiency of video-assisted intubation when compared to conventional laryngoscopy[9].

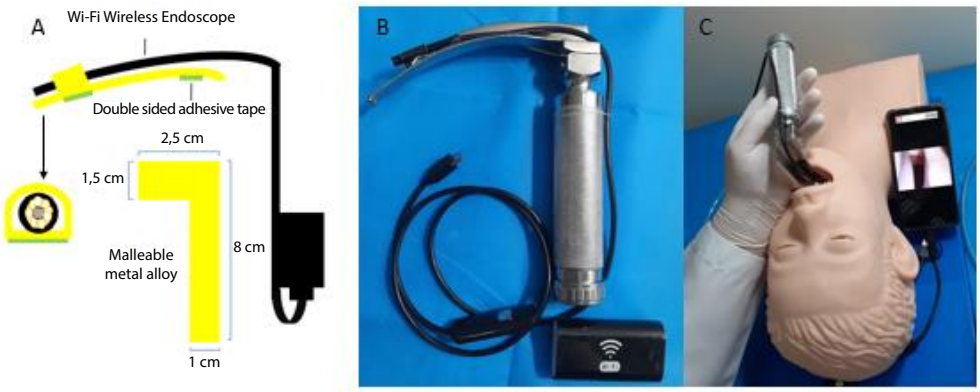
Therefore, video-assisted intubation training can bring positive results to medical education, since it facilitates learning about airway access[10]. It may be possible to adapt a low-cost device with a camera to the conventional laryngoscope for the teaching of orotracheal intubation in a remote teaching environment.

METHODS

The handcrafted device for video-laryngoscopy (Figure 1) is a low-cost adaptation of indirect (video-assisted) laryngoscopy, at a cost of US$20.00. it allows training on manikins in two modalities: direct laryngoscopy (without device) and indirect (with a device). The device with the camera is coupled to a conventional Macintosh-type laryngoscope (Table 1). The endoscopic camera is a 2.0 megapixel Wi-Fi Wireless Endoscope, with a diameter of 8mm, and variable cable length depending on the manufacturer. It has a USB output at its end, which allows direct connection to cell phones, computers or tablets, or even to a Wi-Fi transmitter (Wireless Fidelity), which allows visualization of laryngoscopy within a radius of 5 to 30 meters. The image has a focal length of 4 to 6 cm and the LED light (light-emitting diode) of the camera associated with the light from the conventional laryngoscope improves the visualization of the oropharynx image.

The base of the camera is attached to a malleable metal alloy, enabling the adaptation to the laryngoscope blade

Figure 1. Low-cost handcrafted device for videolaryngoscopy.



Source: Prepared by the authors.

Schematic figure of a homemade device that makes it possible to attach it to a conventional Macintosh-type laryngoscope, turning it into a videolaryngoscope. (A) Diagram for making the device; (B) Device coupled to a conventional Macintosh-type laryngoscope; (C) Use of the handcrafted device with a camera attached directly to the cell phone, one of the uses of the device.

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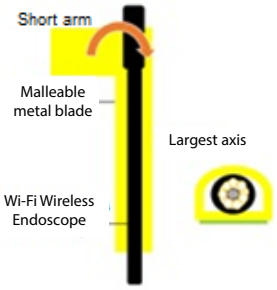
(according to the step-by-step diagram in Chart 1). It can be used on any laryngoscope blade, regardless of the number. For this purpose, the handcrafted device needs a distance of 2 cm from the distal end of the blade. The double-sided adhesive tapes assist in introducing and removing the device, facilitating its use when videolaryngoscopy is required.

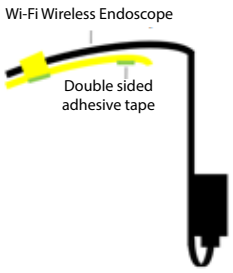
RESULTS

The handcrafted videolaryngoscopy device connects to electronic devices (e.g., cell phones). The visualization of the laryngoscopy image can be visualized in three situations: directly on the electronic device that is connected to the USB output; if connected to the box that transmits the Wi-Fi, it can

Chart 1. Device assembly guidelines.



Use hot glue to affix the largest axis camera (Wifi wireless endoscope) to the metallic blade.

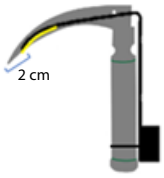


- Make sure the camera's horizon is adjusted before carrying out the procedure.

Bend the short arm of the metal blade in an "L" shape encircling the camera.

- This aids in camera horizon stability.

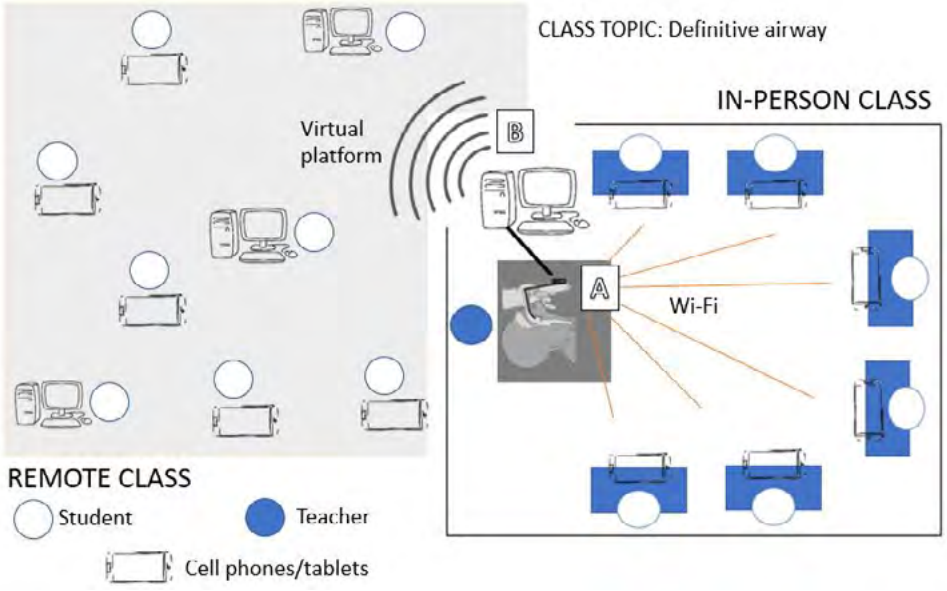
Insert the double-face adhesive tapes in the lower region of the metallic blade. The metallic blade will shape the laryngoscope blade (curved or linear), the adhesives facilitate the removal and adjustments.



Adapt the handcrafted device to the laryngoscope, distancing 2cm from the distal end of the laryngoscope. The plastic tape helps fixing the optical fiber to the laryngoscope handle.

Source: prepared by the authors.

Figure 2. Low-cost handmade device application.



Source: prepared by the authors

Figure 2 illustrates the application of the handcrafted device. (A) use in in-person classes improving the visual quality of the procedure in the training rooms; (B) visualization of the laryngoscopy for the remote class through the use of virtual platforms.

be seen by electronic devices connected in a close radius (5-30 meters), without device limit (e.g., in a classroom – Figure 2); and if the videolaryngoscopy device is connected to the computer, the image can be transmitted remotely, through virtual platforms, to other electronic devices regardless of the distance (Figure 2).

DISCUSSION

Adequate airway management is a factor that can save lives; for it to be successful, the health professional must have adequate mastery of the laryngoscopy technique and know how to deal with factors that increase the procedure complexity, such as environmental factors and patient profile[3]. The use of video devices in these procedures has improved performance in orotracheal intubation, both in the procedure itself and in its use for medical training. Videolaryngoscopy improves the visualization of oropharyngeal structures, increases the distance between the face of the person performing the orotracheal intubation and the patient's oral cavity. This allows an adequate approach in complicated intubations[11]. It reduces the exposure of the patient's oropharyngeal secretions to the team performing the intubation, as well as reducing the possibility of infections such as COVID-19.

The video laryngoscopy device has satisfactory rates regarding orotracheal intubation in patients with no experience with conventional laryngoscopy[12]. Pieters et. al. (2016) used seven models of video laryngoscopes (indirect visualization of the oropharynx) and compared them with the laryngoscope with direct visualization (classic, Macintosh type) in intubations with manikins. He observed that all were better with conventional laryngoscopy - possibly because it was a model that everyone already had contact with. When comparing the video-laryngoscopes, the devices that have a Macintosh-type blade (e.g., C-MAC) showed a more agile intubation and had a higher degree of satisfaction. The study also reports that with models with a non-classical blade, such as the Airtraq and Pentax AWS, the groups needed more attempts to be even successful, possibly because it was a laryngoscopy blade with a new conformation, unfamiliar to the assessed professionals. The handcrafted device adapts the Macintosh-type blade, and its use allows training in direct and indirect laryngoscopy, as the device is easily attached to the laryngoscope and can be removed at any time.

The visualization with details of the oropharyngeal structures collaborates with the success of the orotracheal intubation procedure, facilitating the teaching in simulations, in the teacher's demonstrations to the student and the visualization of the procedure performed by the student to be appraised by the teacher. Thus, the skills acquired in simulation environments, allows training that can result in improvements in outcomes for real-life patients, in which some studies demonstrate a reduction in mortality[13].

Social distancing measures have affected universities during the pandemic. The migration from face-to-face activities to remote ones through virtual platforms added difficulties in relation to the teaching of practical skills in medical training[14]. The use of video devices, associated with technologies such as transmission of images via Wi-Fi (one can view the image with the performer close by), or image transmission through sharing on virtual platforms, helped in academic teaching. The low-cost video-laryngoscopy device facilitates the practice of intubation, as well as allowing its use for demonstration of the procedure and assists in the visualization for those involved in the teaching of orotracheal intubation. This study is limited to the expository method of a teaching model using a handcrafted video laryngoscopy device, and the teaching method was not validated.

CONCLUSIONS

The use of the low-cost handcrafted device can be part of the technical teaching of orotracheal intubation. Its application in medical teaching can be used in-person or remotely, improving the visibility of the oropharynx. This possibility of use complements traditional teaching and opens doors to other teaching modalities.

AUTHORS' CONTRIBUTION

Renato Fernando Cazanti: first author. Carlos Edmundo Rodrigues Fontes: Research advisor. Bruno Filipe Viotto Petta: second author.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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