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## Endotracheal intubation using smartphone endoscope camera

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### ABSTRACT

Videolaryngoscopy is a useful tool to visualize oral cavity so that makes it easier to intubate for the patients who have difficult airways. However, due to its high initial purchase and maintenance cost, it is not widely spread and used frequently. Recently, Smartphone endoscope camera is sold at low prices from online retails. We attached a smart phone endoscope camera to a conventional laryngoscope. It visualized intra-oral structures on the smartphone using an Android application. Endotracheal intubation trial on a manikin was successfully done with it. We are introducing a novel way to replace videolaryngoscopy which can be used with limited medical resources or in purpose of intubating education.

**Key words:** Difficult airway, Intubation, Videolaryngoscopy, Smartphone

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### Introduction

There are always possibilities that even well-trained, experienced anesthesiologists may face risky situations while trying endotracheal intubation of the patients with difficult airways. Difficult airways are found in patients who have obesity, anatomical abnormalities, cervical injuries or pathologic changes in oral cavities etc. Although videolaryngoscopy (VL) is introduced and used in many challenging circumstances, the high initial cost of investment remains a deterrent for the widespread adoption of VL over conventional direct laryngoscopy [1]. And according to the types of VLs, users may have to pay some efforts in sterilizing blades or maintaining batteries charged. They may also cost additional charge to buy disposable parts of VL, one-use blades, for instance. As smartphones are widely spread recently, the related devices are developed and diversified. Among the products sold to general populations, there are some which can be used in medical fields with a little modification or improvement. Smartphone endoscope camera is one of them and we want to introduce the way how we can

use it in endotracheal intubating and education.

### Materials and Method

Authors chose a smartphone endoscope camera that contains C-MOS (Complementary metal oxide semiconductor sensors) type camera. The endoscope camera diameter was 5.5 mm and the cable was 1 m long with flexible fiber which could be bended as needed. There were 6 LED lamps on the head of camera so we could adjust the light. (Lightcom, [www.comsmart.co.kr](http://www.comsmart.co.kr), Koera, 20USD) (figure 1) We attached the endoscope camera about 3 cm from tip of a McIntoshi laryngoscopy blade and fixed it with clean tape. Then the other end of cable was connected to Android smartphone (Samsung galaxy S5) which supported OTG (on-the-go) function. (figure 2)

### Result

The real time vision was played through the android application 'Netweencam' ([www.netween.co.kr](http://www.netween.co.kr), Korea) and endotracheal intubation into a training manikin was tried watching the vision on the smartphone. Conventional intubating technique was used until the blade was introduced into the oral cavity and afterwards, endotracheal intubation was done

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successfully only by watching the vision played on the

smartphone, not seeing directly. (Figure 3, 4)

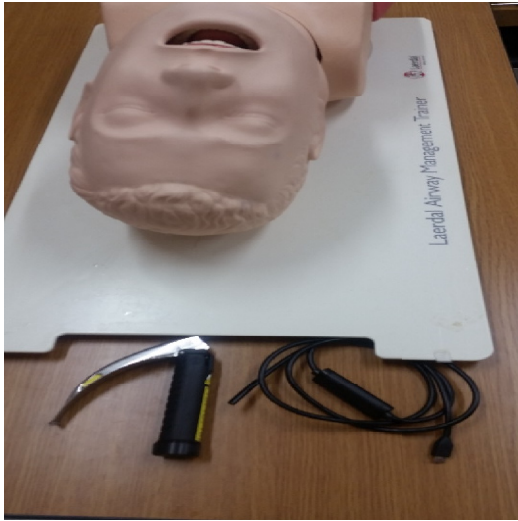


Fig 1: LED lamps on the head of camera to adjust light



Fig 2: Cable connected to Android smartphone



Fig 3,4: Conventional intubating technique was used until the blade was introduced into the oral cavity and afterwards, endotracheal intubation was done successfully only by watching the vision played on the Smartphone, not seeing directly.

### Discussion

It definitely is very attractive that it is possible to replace an over thousands of dollars priced VL with only 20 USD and a smartphone. However it still has a few limitations. First of all, since the smartphone endoscope camera is not approved for medical usage, the safety problems exist. The cable materials that contact with patients can be hazardous and endotracheal aspiration with camera particles can happen when the camera lens is damaged while

intubating procedure. Secondly, it takes some times to get used to find an appropriate place or direction to fix the camera. But these problems may be overcome by developing it into approved medical devices. The materials of fiber or camera may be altered that are not dangerous within human body, or laryngoscopy blade may be improved into a special form that contains a cavity for placement of the endoscope camera and cable so the device is fundamentally separate from

human body and never contact. Using smartphone endoscope camera for endotracheal intubation is inexpensive over dozens of times than the VLs. Hence, only if it is developed to use in medical fields, which means it is approved not having potential danger for human body, it can be used for the doctors or paramedics who are not skilled in intubation, or for the physicians in local clinics where trained human resources lack in emergency situations. While the intubating procedure, the real time videos can be saved and captured through Android application so the exact time and medical record are left if needed. Furthermore, because the third-party people are also able to watch the process of intubation repeatedly, it may be used for educational purpose of students or novices. It is a known fact that VL is useful in educating novices of intubation [2], this method can replace the high-priced VLs in intubation training with

manekins. The usage of smartphone camera may extend to other medical fields. For example, it may be used to show a patient's intra-oral or dental status in real time while a dentist is explaining his or her conditions. And even an otolaryngologists can use it to check into the ear or nasal cavity. In conclusion, more studies are needed to make this kind of instruments useful, which is easily accessible with low costs, in diagnosing or treating patient

#### References

1. Zaouter C, Calderon J, Hemmerling TM. Videolaryngoscopy as a new standard of care. *Br J Anaesth* 2015;11(2) : 181-3.
2. Aseri S, Ahmad H, Vallance H. Video Video laryngoscopy improves endotracheal intubation training for novices. *Br J Anaesth* 2015;1(1):133.

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