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SHORT SCIENTIFIC COMMUNICATION

A novel, cheap and easy to build FESS trainer

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ABSTRACT

BACKGORUND. Simulation models have slowly been gaining a place in training and surgical skills, before attending the operating theatre. This paper presents a model that allows the trainee to practise the functional endoscopic sinus surgery (FESS) training in a safe, non-patient facing environment.
MATERIAL AND METHODS. The method can be practised away from the operating theatre and the skills developed can then be transferred to the operating theatre. To create our FESS simulator, we use a cardboard tube and sheet, scissors, markers, cutter, foam, needles, catheters, plasticine, an inflatable balloon, a 10g lumbar puncture needle, one 5 cc syringe, two Blakesley forceps (straight and angled) and a 0° and 30° Hopkins rigid optics. In this simulator you can practise a puncture of the inferior turbinate, the endoscopic depth, remove a polyp, balloon dilation, a partial ethmoidectomy.
RESULTS. We describe a cheap and easy to build FESS training model, which allows the resident to practise this technique in a risk-free environment, while guaranteeing the reproducibility of the technique under similar conditions.
CONCLUSION. The high cost of digital simulators does not allow possible spreading this technology in every department. For that reason, the purpose of this paper is the acquisition of a set of skills that allow the resident to go to the operating room with clear concepts about the basic techniques.
KEYWORDS: FESS, rhinology, endoscopic surgery, simulator.

INTRODUCTION

Simulation models have slowly been gaining a place in training and surgical skills, before attending the operating theatre. Simulation-based education offers a proven means of acquiring surgical skills in a safe environment where deliberate practice can lead to procedural competency[1].

Endoscopic sinus surgery is a technically demanding procedure, requiring strong endoscopy skills[2], and the functional endoscopic sinus surgery (FESS) performed with a meticulous technique significantly decreased patient morbidity and trauma[3].

Commonly, endoscopic sinus surgery training has relied on cadaveric dissections and, more recently, the virtual reality simulation (Endoscopic Sinus Surgery Simulator ES3) has proven to be a valuable and effective method of allowing residents to prepare for sinus surgery outside of the operating room[4]; however, the price of this equipment makes it difficult to acquire, being necessary the development of alternative technologies to perform these practices.

This paper presents a model that allows the trainee to practise the FESS, training in a safe, non-patient facing environment. The method can be practised away from the operating theatre and the skills developed can then be transferred to the operating theatre.

MATERIAL AND METHODS

To create our FESS simulator, we use a cardboard tube (10cm x 6cm = Length x Diameter) and sheet, scissors, markers, cutter, foam, needles, catheters, plasticine, an inflatable balloon, a 10g lumbar puncture needle, one 5 cc syringe, two Blakesley forceps (straight and angled) and a 0° and 30° Hopkins rigid optics.

On the cardboard tube we will draw the lower, middle and upper turbinates structures and then, with the cutter, we will make the incisions in the cardboard tube to define our turbinates; next, we will move medially, giving relief to the turbinal. After this maneuver, we will cut out a piece of our cardboard sheet that will represent the nasal septum. Afterwards, it is necessary to design a wooden base on which we will place our simulator.

The plasticine will be used to cover the turbinates simulating the turbinal mucosa, then the needles are placed at different distances from the entrance of our cardboard tube and the balloon can enter it through what will be the ostium of the maxillary sinus (Figures 1 and 2).

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Figure 1 Frontal view of the FESS trainer

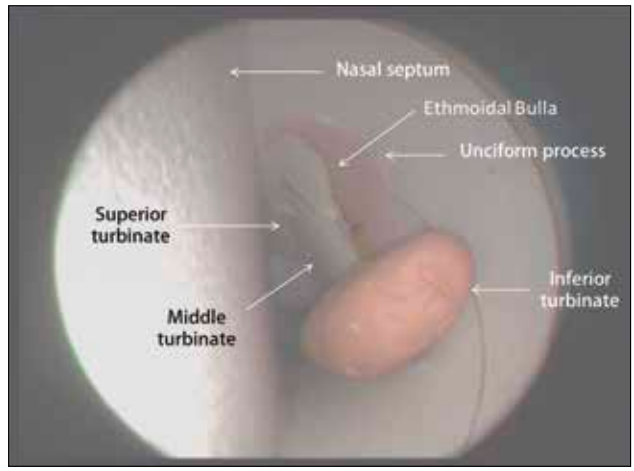

Figure 2 Inside view of FESS trainer

Once the simulator has been completed, we can proceed to perform the following exercises:

- ***Puncture of the inferior turbinate (Turbinoplasty)*:** with a 10g lumbar puncture needle and a 5cc syringe, under endoscopic vision, we will make a puncture in the plasticine of our inferior turbinate. With this manoeuvre we can simulate the placement of local anesthesia at the level of the inferior turbinate and we can practise the technique employed in radiofrequency turbinoplasty or ultrasonic cavitation (Figure 3).
- ***Endoscopic Depth***: after inserting the needles at different depths (2 cm, 3 cm and 4 cm) in the nasal cavity, you can try to place the catheters in them with the Blakesley forceps. With this exercise, the accuracy needed to perform a FESS will be achieved (Figure 4).
- ***Removing a polyp***: a balloon is placed in the maxillary ostium pulling from outside. Under endoscopic vision, we will try to locate the ostium and the root of the polyp, then try to remove it in a careful way (Figure 5).
- ***Maxillary Balloon dilation:*** you can practise the balloon dilation sinuplasty technique if you have the necessary tools at your center.
- ***Ethmoidectomy:*** you put a strip of paper that simulates the uncinate process and a foam strip that simulates the ethmoid bulla. Using the Blakesley forceps, you can try to remove these with a similar maneuver necessary to carry out an anterior partial ethmoidectomy.

These basic exercises that we propose here are an example to begin developing practices in the simulator, and are the starting point from which the resident may develop much more.

DISCUSSIONS

Current methods of teaching sinus surgery to residents involve didactic instruction, textbook study, two-

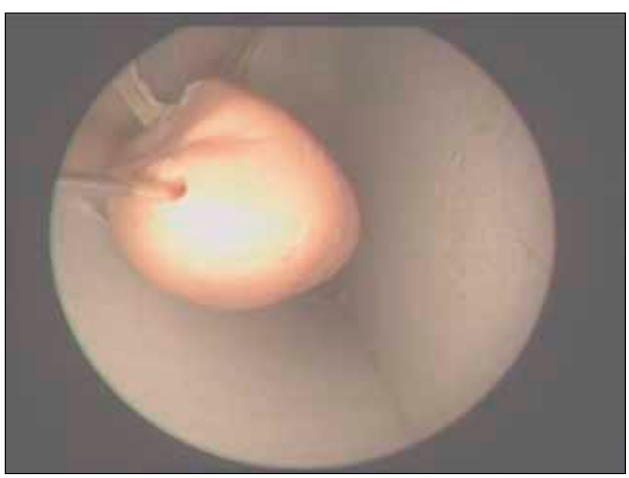

Figure 3 Puncture of the inferior turbinate (turbinoplasty)

Figure 4 Endoscopic depth exercise, trying to place the catéter in the needle

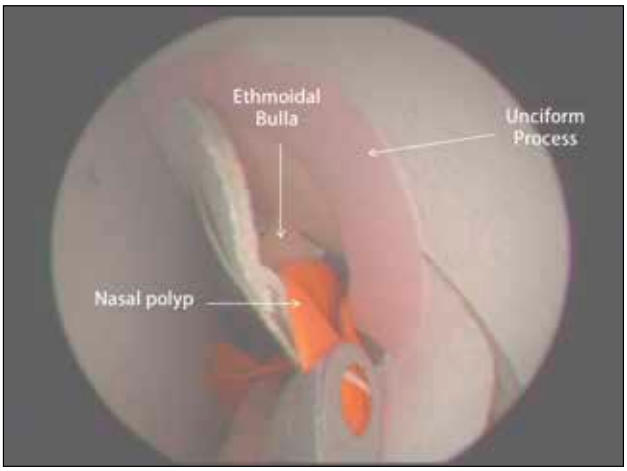

Figure 5 Removing a polyp with an angled Blakesley forceps

dimensional atlases, teaching videos, cadaver dissection and direct surgical observation.

In November 1999, the Institute of Medicine released the report "To Err is Human", which stated that an estimated 44,000 to 98,000 medical errors result in patient deaths each year[5]. Therefore, it is important to know that surgical misadventures can seriously damage vital structures that surround the area, including the brain, eyes, optic nerves and internal carotid arteries. For that reason, it is not surprising that sinus surgery has become the most common cause for litigation in the field of otolaryngology.

This FESS simulator system offers an excellent running stability during real-time interaction and is a highly realistic model regarding the anatomy of the nose cavity, the lateral nasal wall and the middle meatus, its visualization, manipulation, and also allows working with the basic tools required to perform each procedure. In addition, the manufacture of this simulator is really economical, allowing the use in any ENT department where residents develop their training.

We must take into account that our simulator cannot simulate a situation of bleeding during surgery, which is maybe its major limitation, and it is not possible to practise the approaches to the frontal or sphenoid sinus. But the main objective of this low-cost trainer is to learn the steps of the FESS technique and learn the basic tools for its implementation, as well as to work in depth with a 2-dimensional image.

Due to the limited number of residents in any one training program, the ability to design a full factorial experiment with significance was an impossible task when this kind of study was undertaken. However, several studies have shown the benefits of learning the FESS techniques in the development of surgical skills based on the use of simulators. For that reason, further studies are under way to establish the face, content and construct validity of this model, through additional testing to demonstrate the value that starting the training in FESS might have to residents.

CONCLUSIONS

We understand that there is a trend towards the development of high-resolution digital simulators, very similar in anatomical features, but the high cost of purchasing these does not allow possible spreading this technology. For that reason, in this paper we describe a cheap and easy to build FESS training model, which allows the resident to practise this technique in a risk-free environment, while guaranteeing the reproducibility of the technique under similar conditions, and whose purpose is the acquisition of a set of skills that allow the resident to go to the operating room with clear concepts about the basic techniques.

Conflict of interest: The authors have no conflict of interest.

REFERENCES

1. Satava R.M. - Emerging trends that herald the future of surgical simulation. Surg Clin North Am., 2010;90(3):623-633. doi: 10.1016/j.suc.2010.02.002.
2. Kennedy D.W. - Functional endoscopic sinus surgery: Technique. Arch Otolaryngol., 1985;111(10):643-649.
3. Stammberger H., Posawetz W. - Functional endoscopic sinus surgery. Concept, indications and results of the Messerklinger technique. Eur Arch Otorhinolaryngol., 1990;247(2):63-76.
4. Fried M.P., Sadoughi B., Weghorst S.J., et al. - Construct validity of the endoscopic sinus surgery simulator: II. Assessment of discriminate validity and expert benchmarking. Arch Otolaryngol Head Neck Surg., 2007;133(4):350-357.
5. Kohn L.T., Corrigan J.M., Donaldson M.S. - To err is human: building a safer health system. Washington, DC: National Academy Press, 1999;pp.1.