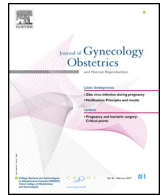Available online at

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Original article

# Hysteroscopic resection on virtual reality simulator: What do we measure?

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## ARTICLE INFO

## ABSTRACT

*Objective.* – The objective was to compare results of two groups of population (novices and experts) on a virtual reality simulator of hysteroscopy resection for different metrics and for a multimetric score to assess its construct validity.

*Materials and methods.* – Nineteen gynecologist who had at least 5 years of experience with hysteroscopy and self-evaluated their expertise at 4/5 or 5/5 were included as expert population. Twenty first-year gynecology residents in Paris were included as novice population. A standardized set of 4 hysteroscopy resection cases (polypectomy, myomectomy, roller ball endometrial ablation and septum resection) was performed on a virtual reality simulator (HystSim™) by the group of novices and experts. Results obtained on the simulator for overall score and for the parameters were compared by applying the Mann–Whitney test.

*Results.* – Overall score of novices and experts were significantly different for three resection cases (polypectomy $P < 0.001$, myomectomy $P < 0.001$, roller ball endometrial ablation $<0.001$). The overall score was not different in the septum resection ($P = 0.456$). For the four cases, the economy score (included cumulative path length, procedure time and camera alignment) were statistically different between novices and experts (polypectomy $P < 0.001$, myomectomy $P = 0.001$, roller ball endometrial ablation $P < 0.001$, septum resection $P < 0.001$).

*Conclusion.* – The overall score on HystSim™ was able to discriminate novices between experts on polypectomy, myomectomy and roller ball endometrial ablation cases but not on septum resection. The economy score was the more reliable to reflect the surgeon experience. It could be used to evaluate and to train students on hysteroscopic resection on a virtual reality simulator.

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## Introduction

Surgery residents spend less and less time in the operating room (OR) to learn technical skills [1]. Obstetrics-gynecology residents must become proficient in both surgical and obstetrical procedures, and advances in technology require them to learn more skills in less time [2]. Most gynecological procedures are now performed endoscopically [3]. Specific training is needed to acquire endoscopic surgery skills [4,5]. Hysteroscopy is a widely performed endoscopic procedure and must therefore be taught effectively to all gynecology residents [6]. Many recommendations underline the importance of developing new training methods that residents can use outside the OR [7–10]. Virtual reality (VR) simulation has proved effective in improving laparoscopic surgery skills [11–16]. HystSim™ is a VR simulator designed by VirtaMed® (Zurich, Switzerland) to replicate many hysteroscopic surgical procedures [17]. Hystsim™ seems to meet the five requirements of VR simulators [18] first described by Richard Satava [19]. An important advantage of VR simulators is that they provide automated feedback to the trainee, in the form of a score based on a variety of parameters [20]. Scoring based on multiple parameters has been shown to discriminate effectively between experts and novices [21–23]. The mutimetric score system (MMSS)

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provided by HystSim[TM] was based on the opinion of two experts, and its cut-off values were defined arbitrarily. Its construct validity has been established only for diagnostic and Essure® procedures [24,25] and not for resection procedures [26]. On different studies the overall score was not discriminating between levels of experience in performing polyp or myoma resection [27,28].

Here, the objective was to test the discrimination between experts and novices of MMSS of HystSim[TM] on a standardized course of four resection cases (polypectomy, myomectomy, septum, endometrial ablation). The discrimination of experts and novices from the MMSS will confirm the construct validity of the resection cases but also allow to set up a training program for novices on this simulator with a valid evaluation tool.

## Materials and methods

### Simulated resection procedures

We used HystSim[TM] with the pelvic model. The simulator has several resection cases with different level of difficulty which are numbered. We had selected four resection training cases available on HystSim[TM] (Fig. 1) based on their realism, average difficulty level, and educational value in accordance with a curriculum developed using the Delphi method in a previous study [29]. The study participants had to perform the set of four simulation procedures. After a short standardized briefing about the simulator, the participants were allowed 10 min of familiarization with HystSim[TM], during which they could perform the procedure of their choice, except for the 4 cases selected. Then, each participant performed the four selected procedures: polypectomy (medium 4), myomectomy (difficult 4), roller ball endometrial ablation (medium 1), and advanced resection – septum. Each procedure was performed once. Participants could decide to stop at the end of the procedure of their choice instead of completing all four procedures.

### Study participants

The study was approved by the gynecology ethics committee (CEROG 201-GYN-1203). Written informed consent was obtained from each participant before study inclusion. All data were recorded anonymously. Each participant completed a questionnaire about skill level and experience in hysteroscopy.

We enrolled two groups of participants: experts and novices. The experts participated in the study during an international congress. All gynecologists who agreed to participate were included if they had at least 5 years of experience with hysteroscopy, self-evaluated their expertise at 4/5 or 5/5. Novices were recruited among all first-year gynecology residents in Paris, France.

### Criteria of judgment

On the Hystsim[TM] the overall score of MMSS includes five subset scores: resection score, safety score, economy score, visualization score and fluid handling score. Each subset score
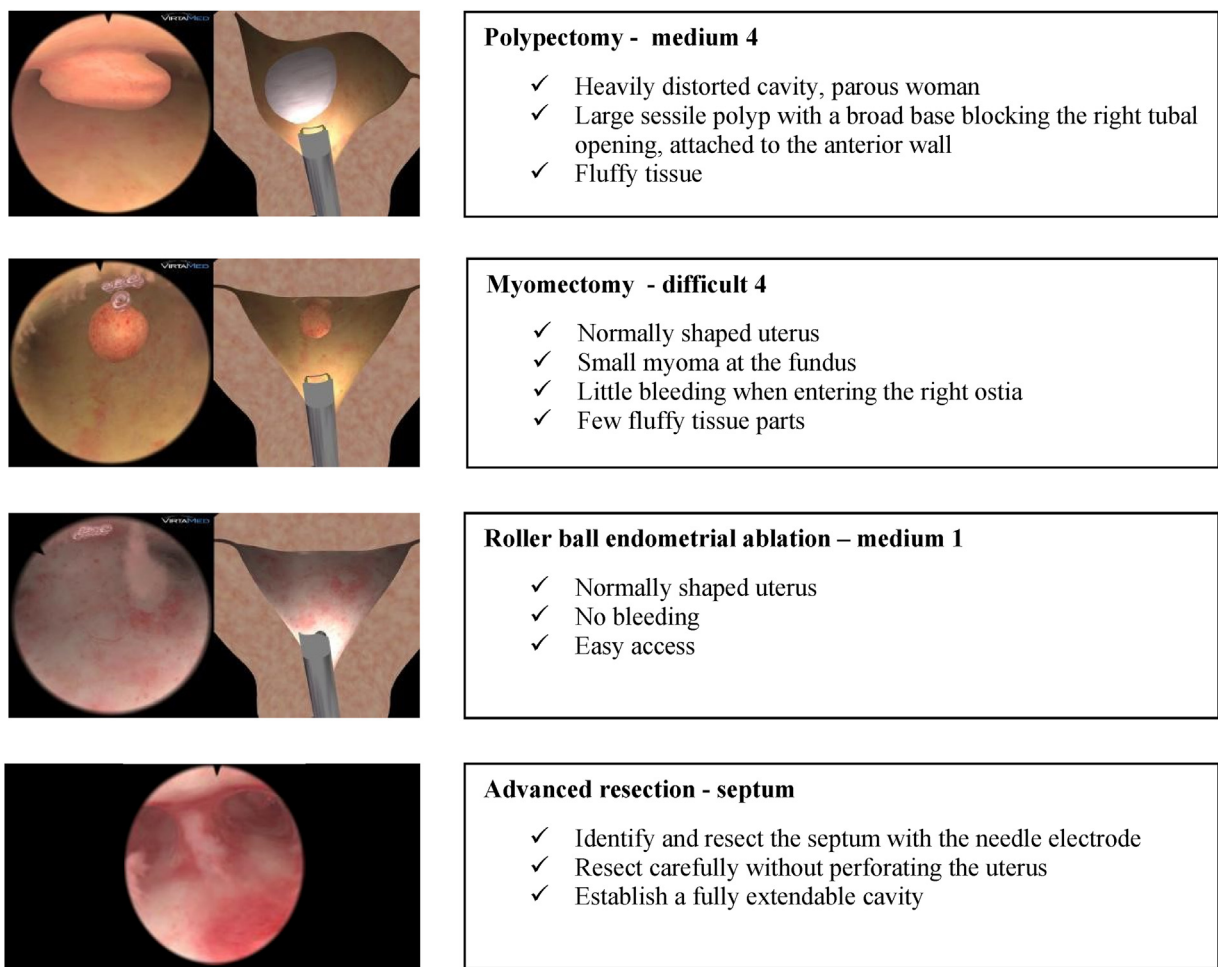


**Polypectomy - medium 4**

- ✓ Heavily distorted cavity, parous woman
- ✓ Large sessile polyp with a broad base blocking the right tubal opening, attached to the anterior wall
- ✓ Fluffy tissue

**Myomectomy - difficult 4**

- ✓ Normally shaped uterus
- ✓ Small myoma at the fundus
- ✓ Little bleeding when entering the right ostia
- ✓ Few fluffy tissue parts

**Roller ball endometrial ablation – medium 1**

- ✓ Normally shaped uterus
- ✓ No bleeding
- ✓ Easy access

**Advanced resection - septum**

- ✓ Identify and resect the septum with the needle electrode
- ✓ Resect carefully without perforating the uterus
- ✓ Establish a fully extendable cavity

**Fig. 1.** Four cases used to assess performance on HystSim[TM].