Medical Devices: Evidence and Research

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ORIGINAL RESEARCH

A Comparison of the Bouquet Speculum and Traditional Two-Blade Speculum in Medical Student Training for Female Gynecological Exams

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Introduction: The objective of this study was to compare the Bouquet Speculum™ to a traditional two-blade speculum on a complex-anatomy vaginal task among preclinical medical students. The novel task trainer was designed and created to simulate obese anatomy for the complicated speculum exam. This study was conducted at Rocky Vista University College of Osteopathic Medicine in Parker, Colorado.

Methods: A novel vaginal model simulating anatomy that is prone to lateral wall collapse was used to compare the speed and preference of a traditional two-blade vaginal speculum to the Bouquet speculum™ among first and second-year medical students (n=47) in a randomized crossover study. Students performed an endometrial biopsy, and quantitative and qualitative measures were recorded including time, speculum preference, difficulty, and confidence.

Results: Students successfully placed the endometrial biopsy pipelle faster using the Bouquet speculum™ compared to the traditional two-blade speculum ($p < 0.0001$). Students self-reported confidence level was significantly associated with faster times, regardless of the speculum used ($p=0.0043$).

Conclusion: The Bouquet Speculum™ significantly reduces the time to completion of an endometrial biopsy performed on a novel vaginal model simulating obese anatomy compared to the traditional two-blade speculum.

Keywords: medical education, simulation, speculum, gynecology

Background

Task trainers used in medical education can simulate "normal" anatomy or pathology. Despite a prevalence of over 40% in America, obesity-related topics remain somewhat isolated within medical education and simulation.[1,2] A survey of medical students revealed that only 12% of them feel prepared to work with patients who are overweight or obese.[3] The novel task trainer developed by the study authors was designed to prepare students for gynecological exams on complex anatomy in an educational setting, filling a gap in representation that the current standard trainers lack.

Some methods to overcome anatomy challenges include use of a condom or a cut glove placed around the traditional two-blade speculum to prevent lateral wall in-folding.[4] Alternatively, a blind pap smear can be performed without a speculum, however studies have found that only 57% of the blind pap smears resulted in a specimen containing the transitional zone of the cervix, compared to 90% of traditional pap smears using speculums.[5] The Bouquet Speculum™ is a novel speculum designed with complex anatomy in mind. The Bouquet Speculum™ uses five blades that expand radially, increasing visualization and decreasing the chance of lateral wall in-folding.[6]

A simulated endometrial biopsy was chosen for this study over the more routinely performed pap smear due to the ability to add a quantitative marker of success. By using standardized models, investigators will know exactly how far the pipelle should be inserted into the uterus. Thus, a simulated endometrial biopsy is preferred to a simulated pap smear in evaluating student-performed exams because of its objective end-point which we correlate to a successful speculum exam. This group

https://doi.org/10.2147/MDER.S556660
Received: 31 July 2025
Accepted: 10 December 2025
Published: 8 January 2026

hypothesizes that the Bouquet Speculum reduces procedural time and perceived difficulty of completing the exam compared to the traditional speculum.

Methods

Novel Task Trainer for Complex Vaginal Anatomy

A novel task trainer was designed and developed in the Simulation Department at Rocky Vista University. The new task trainer was made by modifying the Guamard SIMA GYN/AID Gynecologic Simulator using silicone and memory foam inserts (Figure 1). The vaginal canal was lengthened with silicone. Memory foam was cut and inserted into the canal to represent collapsing side-walls. This material was low-cost and is able to be compressed without compromising its shape on expansion. The goal of the task trainer was to emulate the typical lateral wall in-folding that can be observed in patients with increased adipose tissue or a weak pelvic floor. This novel model was compared to the non-modified task trainers that are routinely used at this institution in a study titled Advancing Gynecological Training: Comparative Analysis of a Novel Complex Vaginal Anatomy Simulation Model to Established Task Trainers (RVU IRB #2023-251). Both quantitative data - assessing time to visualization of cervical os, and qualitative data - assessing subjective difficulty rating on a 5-point Likert scale, were collected. This preliminary study showed that the novel task trainer was successful in modeling a more difficult speculum exam. With this result, we advanced to the present study model to evaluate and compare the efficacy of the Bouquet Speculum™ to the standard two-blade speculum.

Bouquet Speculum™ vs Standard Speculum

Using the novel vaginal model, we compared the ease and success of medical students performing a simulated endometrial biopsy with the Bouquet Speculum™ compared to a standard two-blade vaginal speculum (Figure 2).

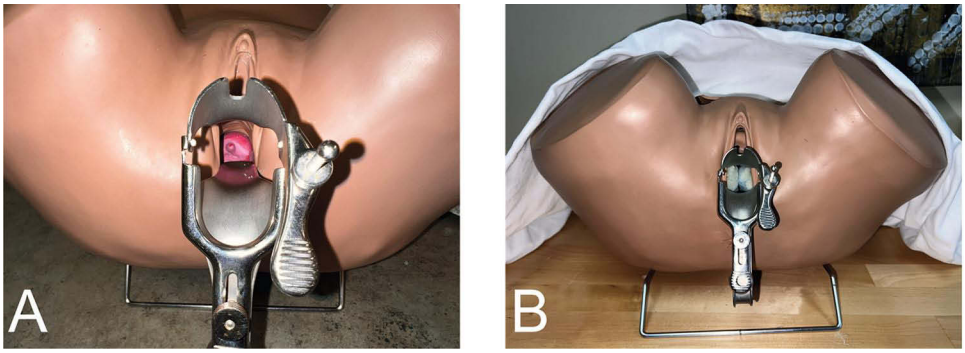

Figure 1 Novel vaginal anatomy task trainer inserted into the Guamard SIMA GYN/AID Gynecological Simulator. A two-blade speculum has been placed into the non-modified model (**A**). For comparison, a two-blade speculum has been placed in the novel task trainer showing complete visual obstruction of the cervix due to the "lateral walls" protruding through the blades of the speculum (**B**).

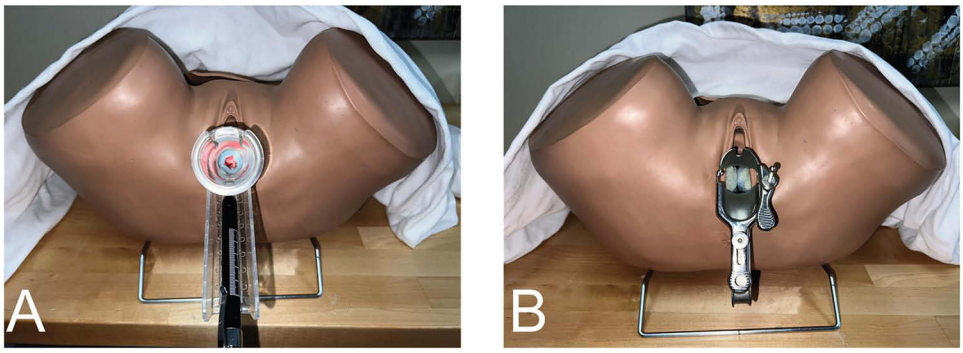

Figure 2 Novel vaginal anatomy task trainer inserted into the Guamard SIMA GYN/AID Gynecological Simulator. The Bouquet Speculum™ has been placed to attenuate lateral wall infolding demonstrated via use of memory foam inserts (**A**). For comparison, a metal two-blade speculum has been placed in the novel task trainer showing complete visual obstruction of the cervix due to the "lateral walls" protruding through the blades of the speculum (**B**).

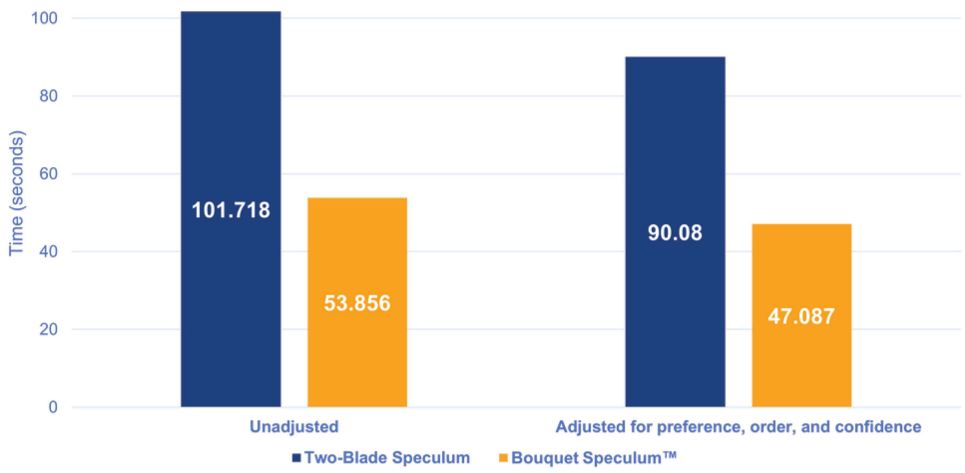

Figure 3 Time to visualization of cervical os and proper insertion of endometrial pipelle between the standard two-blade speculum and the Bouquet Speculum™ using the novel complex vaginal anatomy task trainer. The Bouquet Speculum™ results in a significantly faster endometrial biopsy, even after adjusting for preference, order, and confidence.

Participants were shown a video demonstration of an endometrial biopsy and instructed to perform the procedure on the novel vaginal model using each speculum. Participants were randomly assigned which speculum they started with. Quantitative assessment was measured by time to correct placement of an endometrial pipelle starting when the speculum was picked up. Proper placement of the endometrial pipelle was predetermined by study investigators based on the measured depth of the pipelle within the cervical os. Using anonymous surveys, qualitative assessment was measured by speculum preference, subjective difficulty of the procedure between the two speculums on a 5-point Likert scale, and their general confidence level of their ability to conduct a speculum exam in a simulated environment. The study participants included first- and second-year medical students at Rocky Vista University in Parker, CO. The past experience with speculum exams among the participants averaged between 1 and 6 simulated or real exams.

Results

47 medical students participated in this study. The average time-to-completion ± standard deviation (seconds) of the two-blade speculum and Bouquet Speculum was 101.718±1.082 and 53.856±1.083, respectively ($p < 0.0001$). After adjusting for speculum preference, the order they used the speculums, and how confident they felt, the average times for the two-blade and Bouquet speculums were 90.080±1.183 and 47.087±1.183, respectively ($p < 0.0001$) (Figure 3). Interestingly, the only factor that significantly affected the time was the student's confidence level ($p=0.0043$). The student's preference and order of speculum used were statistically insignificant ($p=0.1746$ and $p=0.0534$). Associations were evaluated using a generalized linear mixed model with a repeated measurement by participant and a negative binomial distribution. The dependent variable was time and the independent variables were the speculum used, speculum preference, order of speculum use, and confidence reported by participant. Univariable and multivariable models were assessed.

Discussion

The Bouquet Speculum™ significantly reduces the time to completion of an endometrial biopsy performed on a novel vaginal model simulating obese anatomy compared to the traditional two-blade speculum. This implies faster visualization of the cervical os, theoretically improving the accuracy and comfort of routine gynecological procedures. As many learners have shown hesitancy towards the care of obese populations,[7] the results of this study show a potential benefit of expanding current medical education to include more obesity-related simulation. Compared to traditional task trainers, the novel trainer used in this study more closely represents the anatomy of patients who are obese or multiparous. The study also suggests that the use of the Bouquet Speculum™ may be of benefit for more successful speculum exams in select patients.

A secondary finding of this study was the statistically significant association between subjective confidence level and speed, regardless of which speculum was used. Additionally, at least in this limited study, we observed that using the students preferred speculum did not significantly improve times.

While the standard two-blade speculum has proven effective in gynecological procedures and exams, the results of this study suggest that the Bouquet Speculum™ may have significant implications for learners and providers who do not routinely perform speculum exams or care for obese patients. Further studies are necessary to demonstrate how this learning model translates to medical student performance on live patients to investigate this long-term benefit.

The positive results of this limited study should encourage industry leading manufacturers to design task trainers that represent different body types.

Strengths and Limitations

The strength of this study is the low-cost and effective method to teach medical students speculum exams on difficult anatomy. The limitations of this study are related to the material used to simulate lateral wall collapse, which in this case was memory foam. As this was a prototype, further innovation in more life-like materials would benefit future students. Additionally, insight into students rationale for their answers to the qualitative questions is missing, as no justification was requested in the survey. A repeat of this study administered to learners with more experience in speculum exams would aid in the analysis of the generalizability of this educational activity.

Ethics Approval

Protocol #2023-196 - A Comparison of The Bouquet Speculum to a Traditional Two-Blade Speculum in Graduate Medical Educational Techniques of Female Genitourinary Exams and Procedures. Rocky Vista University IRB granted approval of this project.

Acknowledgments

Special thanks and acknowledgement are given to Thomas Jackson III, Certified Healthcare Simulation Operations Specialist, and Dr. Isain Zapata, Statistician, for assisting these studies as subject matter experts. We would like to thank and acknowledge the Simulation Center at Rocky Vista University for providing their space and materials for the creation of the novel complex vaginal anatomy task trainer and for their assistance in conducting study trials.

This research was previously presented as a conference poster at the International Meeting on Simulation in Healthcare with interim findings. The poster's abstract was published in *Simulation in Healthcare*, DOI: 10.1097/SIH.0000000000000858. The manuscript presented here includes substantially expanded analysis and discussion.

There was no involvement or support from the manufacturer of the Bouquet Speculum. None of the authors were involved in the development of the Bouquet Speculum or have a personal or financial relationship with the developer, manufacturer, or patent holder of the Bouquet Speculum.

Author Contributions

The authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. Materials used were sourced from Rocky Vista University Simulation Center's existing supply.

Disclosure

The authors report no conflicts of interest in this work.

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