Original Article

Cervical dilation assessment in dilation simulators

Avaliação da dilatação cervical em simuladores de dilatação

Evaluación de la dilatación cervical en simuladores de dilatación

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Abstract

Objective: To compare the number of hits of students in cervical dilation assessment in dilation simulators with and without the use of direct visual validation.

Methods: This is a cross-sectional study with 40 undergraduate obstetrics students from a public university in São Paulo, who assessed cervical dilatations in blind dilatation simulators, in three stages: in the first, they estimated dilations in the simulators; in the second, they sequentially compared the findings in simulators with a direct visual validation tool using the dominant hand and then the non-dominant hand; and in the third step, they simultaneously compared the estimates found in simulators with direct visual validation with the dominant and non-dominant hands. The outcome was the success of cervical dilation in dilation simulators or not, with a p-value ≤ 0.05 considered statistically significant.

Results: We analyzed 240 assessments and computed the hits of students related to cervical dilatation assessment of simulators. There was an increase in the hit rate of 47.1% with the use of direct visual validation (OR= 4.689; 95%CI: 2.601-8.452; p<0.001).

Conclusion: The use of direct visual validation increases the probability of hits by students in cervical dilation assessment in dilation simulators.

Resumo

Objetivo: Comparar o número de acertos dos estudantes na avaliação da dilatação cervical em simuladores de dilatação com e sem o uso de uma validação visual direta.

Métodos: Estudo transversal com 40 alunos de graduação em Obstetrícia de uma Universidade Pública de São Paulo, que avaliaram as dilatações cervicais em simuladores de dilatação às cegas, em três etapas: na primeira, estimaram as dilatações nos simuladores, na segunda, compararam sequencialmente os achados nos simuladores com uma ferramenta de validação visual direta usando a mão dominante e depois a mão não dominante, e na terceira etapa, compararam simultaneamente as estimativas encontradas nos simuladores com a validação visual direta com a mão dominante e não dominante. O desfecho foi o acerto da dilatação cervical nos simuladores de dilatação ou não acerto, com valor de p ≤ 0,05 considerado estatisticamente significativo.

Resultados: Foram analisadas 240 avaliações e computados os acertos dos estudantes relacionados a avaliação da dilatação cervical dos simuladores. Houve aumento da taxa de acerto de 47,1% com o uso da validação visual direta (OR= 4,689; IC95%: 2,601-8,452; p<0,001).

Conclusão: O uso de uma validação visual direta aumenta a probabilidade de acertos dos alunos na avaliação da dilatação cervical em simuladores de dilatação.

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Conflict of interest: nothing to declare.

Resumen

Objetivo: Comparar el número de aciertos de los estudiantes en la evaluación de la dilatación cervical en simuladores de dilatación con y sin uso de una validación visual directa.

Métodos: Estudio transversal con 40 alumnos de la carrera de Obstetricia de una universidad pública de São Paulo, quienes evaluaron las dilataciones cervicales en simuladores de dilatación a ciegas, en tres etapas: en la primera, estimaron las dilataciones en los simuladores; en la segunda, compararon secuencialmente los resultados en los simuladores con una herramienta de validación visual directa usando la mano dominante y después la mano no dominante; y en la tercera etapa, compararon simultáneamente las estimativas encontradas en los simuladores con la validación visual directa con la mano dominante y no dominante. El criterio de valoración fue el acierto de la dilatación cervical en los simuladores de dilatación o el no acierto, con un valor de $p \leq 0,05$ considerado estadísticamente significativo.

Resultados: Se analizaron 240 evaluaciones y se computaron los aciertos de los estudiantes relacionados con la evaluación de la dilatación cervical de los simuladores. Hubo un aumento del índice de acierto del 47,1 % con el uso de la validación visual directa (OR= 4,689; IC 95 %: 2,601-8,452; p<0,001).

Conclusión: El uso de una validación visual directa aumenta la probabilidad de aciertos de los alumnos en la evaluación de la dilatación cervical en simuladores de dilatación.

Introduction

Cervical dilatation assessment in labor is a skill to be acquired during obstetric training, but most of the time students will only achieve this skill and dexterity after completing the course, that is, in their daily work of their profession. Acquiring this ability is necessary, since cervical examination in parturient women assesses the progress of labor and directs the assistance to be used. A systematic review and meta-analysis on devices to measure cervical dilatation during childbirth did not find any feasible solution for measuring dilatation that would help obstetricians be more assertive in this assessment and be more comfortable for parturient women; for this reason the method used called primitive, digital examination, is the gold standard.[1]

The digital measurement technique is based on professionals' proprioceptive skills and clinical experience, so it has traces of subjectivity. Researchers found that, even among an experienced obstetric team, there was a difference of one centimeter (cm) in the inter-examiner digital examination agreement.[2]

For obstetrics professors, providing teaching tools in the assessment of cervical dilatation other than the woman herself in labor is a challenge. If, on the one hand, it is practical and comfortable for students and professors, on the other hand, it violates ethical women's principles, privacy and well-being, when there is an increase in examination frequency and its repetition by more than one professional. In this teaching model, most of the time professors or experienced professionals assess dilatation, inform the measurement in centimeters found to the apprentices. They then perform an examination, already with the subjective impression of another person, without forming their judgment, which may result in inaccurate learning of cervical assessment.[3]

Uterine cervix dilatation models have been created for students to previously train in the laboratory before its beginning in clinical practice. A study assessed how skill in digital cervical examination is acquired in medical students, concluding that it takes 150 repetitions or more on cervical dilatation simulators for students to acquire this skill.[4]

Unlike what has been proposed for the teaching and development of students' skills and competence regarding cervical dilatation verification, this study used a visual tool with measurements of the cervix, i.e., a direct visual validation (DVV) compatible with those found during labor. Thus, students could blindly check their findings in dilatation simulators with something concrete, taking them out of subjectivity.

Given the above, this study aimed to compare the number of hits of students in cervical dilatation assessment in dilatation simulators with and without the use of a DVV.

Methods

This is a cross-sectional study carried out in the laboratory of a public university in the city of São Paulo, Brazil, between October 17, 2019 and March 12, 2020. The population consisted of students from

the second to the ninth semester of an undergraduate course in obstetrics. We included students enrolled, with no age restriction, with or without previous experience in performing a cervical exam, with or without failure in subjects related to childbirth care, with or without a previous degree in any area. We excluded students with non-consent to participate. Students were invited to participate in the research in their classrooms, with prior authorization and agreement of the respective professor. The sample consisted of 40 participants. In order to carry out the research, two of the researchers developed a rigid consistency uterine cervix simulation model. This model consisted of a rubber vulva and a silicone cervix inside, such that external identification of dilatation was not possible. Six identical models with different cervical dilatations were made (1.5 cm; 2.0 cm; 4.0 cm; 5.0 cm; 7.0 cm and 9.0 cm). Below each template, a label indicated the corresponding dilatation. A tool for DVV was also developed, made of transparent acrylic material, with a surface measuring 25 cm × 11 cm × 3 mm (height, width and thickness), containing nine hollow geometric figures, oriented by the diameter in the horizontal direction containing measures corresponding to the uterine cervix dilatation ranging from 1.5 cm to 9.0 cm (Figure 1). This tool was called cervical dilatation guide (CDG). The CDG was registered with the Brazilian National Institute of Industrial Property (*Instituto Nacional da Propriedade Industrial*) (BR 302014004714-0) by a public university.

For data collection, students who agreed to participate voluntarily presented themselves at the school's health laboratory, on the date and time informed by the researchers when invited to the classroom. Initially, the measurements of participants' index and middle fingers of both hands were collected using a conventional tape measure, to control a possible confounding variable when measuring cervical dilatation, as well as to verify if there was a difference in the measurements of these fingers. We measured: index finger length; middle finger length; circumference of middle and index fingers; middle and index finger width; inner diameter between middle and index fingers; outside diameter

Figure 1. Cervical dilatation guide

from middle fingertip to index fingertip. The models with different dilations were positioned in a random sequence on the bench, so that the procedure could be performed in its three stages.

Cervical dilatation was blind to the researchers and participants. In the first step, students were instructed to use the dominant hand and insert the index and middle fingers through the vagina to the cervix in a dilatation simulator. The fingers should be opened until their outer tips reach the opposite margins of the cervical orifice. Thus, they estimated the distance between the fingertips and performed their assessments in centimeters. In the second step, they sequentially compared their estimates using the DVV with the dominant hand and then with the non-dominant hand. In the third stage, they simultaneously compared their estimate of touch to DVV with the dominant hand and then with the non-dominant hand.

A form was used to record the data, completed by the researchers simultaneously with the tests performed. At the end, participants left the place and a laboratory employee who was not part of the study, checked the corresponding dilatations under

the models and informed the researchers, who registered the data in the collection instrument. After each participant left, the same employee, properly prepared, made the models available at random on the bench and a new participant was invited to enter the room and so on until the last student performed the procedure.

In data analysis, mean and standard deviation (SD) were used for the continuous parametric variables. For categorical variables, the number and frequency were computed in percentage. For univariate analysis, the chi-square test or Fisher's exact test were used to assess the association between groups in each cervical dilatation. For multivariate analysis, logistic regression was used to find the probability of a correct assessment rate between groups and to construct a two-tailed 95% confidence interval (CI).

The outcome was to hit cervical dilatation in dilatation simulators or not. The variables were the sequential use of DVV, age, students' college semester, experience with vaginal examination, and normal childbirth follow-up. P-value<0.05 was considered statistically significant. The study followed all ethical principles required for scientific studies. This included voluntary participation and privacy of information. Students voluntarily signed an informed consent form based on the World Medical Association's Code of Ethics (Declaration of Helsinki) for experiments involving humans. This research was approved by the Research Ethics Committee (the institution's name will be informed later) under number 1.322.956, CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 49827815.2.0000.5390.

Results

Participants' age ranged from 18 to 34 years, with a mean age of 23 years, mostly female (92.5%), 95% were right-handed, 35% attended the 8th semester (4th year) and 22.% the 2nd semester (1st year). The mean experience related to cervical examination was four tests performed (SD 6.80), and of childbirths assisted was equal to three (SD 4.24). Table 1 shows the means of anthropometric values of participants' fingers.

Table 1. Right and left finger measurements of undergraduate students in obstetrics

Measurements (cm)	Right Mean (SD)	Left Mean (SD)	p-value
Index finger length	7.16 (0.50)	7.06 (0.49)	0.054
Middle finger length	7.82 (0.56)	7.81 (0.61)	0.743
Circumference (index + middle)	7.54 (0.64)	7.51 (0.67)	0.689
Width (index + middle)	2.95 (0.22)	2.94 (0.23)	0.697
Inside diameter (index to middle)	8.39 (1.01)	8.52 (1.18)	0.365
Outside diameter (index to middle)	10.30 (1.25)	10.40 (1.09)	0.517

When measuring students' fingers, it was found that the mean length of their right and left index and middle fingers was 7 cm and 8 cm, respectively. The circumference and width of the two fingers together (index + middle) was 7.5 cm and 3 cm, respectively. The inside and outside diameters of the maximum expansion reached were 8 and 10 cm. It can be known that there was no significant difference between the measurements of the right and left hand. As for cervical assessment, we sought to identify the number of hits by students in each of the six dilatations presented in the proposed dilatation simulators. The hits were compared with and without the use of DVV sequentially and simultaneously and also between the dominant and non-dominant hand, as described in table 2.

In the univariate analysis, divided by cervical dilatation, the use of sequential DVV with the dominant hand had more success rates in four cervical dilatations with a significant difference (1.5 cm, P=0.007; 2.0 cm, P<0.001; 5.0 cm, P=0.012; and 9.0 cm, P=0.020). This fact justified the more specific analysis on the sequential use of DVV with the dominant hand. The measure hits found by students without the use of DVV were compared with the hits with the use of DVV sequentially with the dominant hand through a multivariate analysis of 240 assessments (total sum of the six cervical assessments of 40 students). Thus, the association was found according to figure 2.

We analyzed 240 assessments and computed students' hits related to cervical dilatation assess-

Table 2. Number of hits in cervical assessments performed in dilation simulators using the sequential and simultaneous DVV of the dominant and non-dominant hand

Cervical dilation in dilatation simulator	Hits In dilatation simulator WITHOUT DVV n(%)	Hits with the use of DVV							
		Sequentially				Simultaneously			
		Dominant hand		Non-dominant hand		Dominant hand		Non-dominant hand	
		n(%)	p	n(%)	p	n(%)	p	n(%)	p
1.5	15(37.5)	23(57.5)	0.007	21(52.5)	0.010	23(57.5)	0.007	23(57.5)	0.007
2.0	17(42.5)	21(52.5)	<0.001	21(52.5)	<0.001	24(60.0)	<0.001	24(60.0)	<0.001
4.0	12(30.0)	13(32.5)	0.716	16(40.0)	0.729	13(32.5)	0.716	14(35.0)	1.000
5.0	11(27.5)	19(47.5)	0.012	17(42.5)	0.477	14(35.0)	1.000	15(37.5)	1.000
7.0	10(25.0)	14(35.0)	0.278	17(42.5)	0.274	12(30.0)	0.451	12(30.0)	0.451
9.0	13(32.5)	23(57.5)	0.020	21(52.5)	0.046	26(65.0)	0.316	26(65.0)	0.316

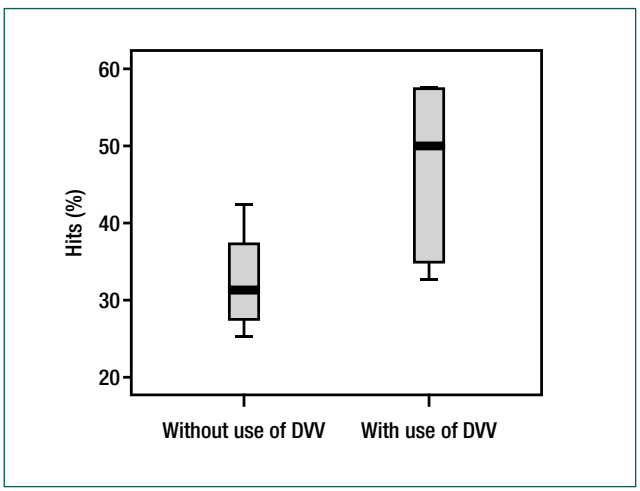

Figure 2. Undergraduate students in obstetrics, according to success rate in the assessment of cervical dilatation in dilatation simulators without and with the use of DVV sequentially with the dominant hand

ment of dilatation simulators. It can be seen that the rate of hits increased from 32.5% to 47.1% with the use of DVV (OR= 4.689; 95% CI: 2.601-8.452; p<0.001).

Discussion

The data presented in this study were related to students' assessment performed in dilatation simulators and not in parturient women. They were limited only to cervical dilatation assessment, not exploring other variables of the changes in the cervix during labor, constituting a limiting factor for the study.

The main finding of this investigation was the increase in the number of hits by students in cervical dilation assessment in dilation simulators using DVV. This is an innovative study that makes an important contribution to teaching in obstetrics. It combines more than one learning style in measuring cervical dilatation, different from what conventionally occurs both in training in simulators and in clinical practice, in which the commonly adopted form is only tactile.

Cervical dilation simulation models are extremely valuable for students to train obstetric vaginal examination before performing it in parturient women during clinical practice, but this didactic resource requires several repetitions for dexterity acquisition, as mentioned by authors.[4]

In this study, when using a visual tool with the cervix dimensions found in parturient women, students were able to simultaneously experience visual sensations (in the CDG) and tactile (simulators), which probably facilitated the perception of the distance found between the index and middle fingers, increasing the number of hits in the assessments.

Although statistically significant hit rates were in two initial dilations, one intermediate and one advanced, it shows that even with the use of DVV, there is still difficulty in precision in intermediate dilations, as in other studies that did not use DVV and accuracy was decreased when dilatation increased or in intermediate measurements.[2,4,5] All these results lead to believe that intermediate dilations are the most difficult to assess, indicating the need for intensification of cervical examination training in these measurements.

Proprioception of the distance between the examiner's fingertips is relatively easier to estimate at shorter distances compared to longer distances, such as those commonly found in dilations of 5 to

7 cm.[2] Moreover, discrepancies in measurements may be caused by anatomical changes as well as limitation of examiners in moving their fingers apart during examination.[6]

In this study, the rate of hits increased from 32.5% to 47.1% with the use of DVV, and the rate of hits only with students' proprioception (32.5%) was similar to that found in other studies that also used dilatation simulators.[4,5] Authors emphasize the importance that should be given to the variability of inaccuracy of intraobserver digital examination in a dysfunctional labor.[4,5] This aspect reinforces the central idea of this study on the importance of the use of objective DVV in laboratory training activities.

The measurements hits in simulators using DVV sequentially was more significant than the hits with DVV simultaneously, which was an unexpected result. It was believed that students, when performing cervical examination and comparing simultaneously with DVV, would have more hits. A possible explanation for this result would be the difference in perception between the right and left hands used in the exam; students used their dominant hand in dilation simulators and their non-dominant hand on the DVV tool at the same time. It is important to note that to clarify this finding, other studies involving cognitive neuroscience with exploration of sensory experiences are necessary, which was not the object of this research.

Anthropometric measurements of the index and middle fingers of students' right and left hands were fundamental for cervical dilatation measurement assessment. The values indicated no significant difference between the two hands. Authors comment that it is necessary for students to better understand how the dimensions of these fingers, together or apart, at different distances, can be used to estimate dilatation.[4,5] Table 1, which presents the values obtained in the measurements, is a contribution of this study, considering that this information is not disclosed in other investigations.

It is important to point out that in clinical practice, the reference for assessment is that the index and middle fingers are around 1.5 cm wide each, therefore, the two fingers together measure about 3 centimeters, which can help students to perceive their measurements and their relationship with cervical examination, in addition to learning that it is possible to introduce both fingers together into the cervix from 3 cm of dilatation.

This study with a single assessment, without previous training of students, showed good results. It is possible that little training would be useful and could improve the accuracy of assessments in simulators using sequentially DVV as an objective measurement tool, perhaps not requiring 150 repetitions or more for skill development, as pointed out in a study.[4] This resource may contribute to the reduction of simulation training time and costs.

Combining different learning styles such as visual, tactile or kinesthetic and auditory may benefit a greater number of students, both for their different ways of retaining knowledge and for developing other modes of learning. An efficient teaching strategy is one that promotes different cognitive styles to improve academic performance.[7]

In this way, the present study, through the innovation of DVV, collaborates with the construction of knowledge and development of skills of obstetrics students in improving cervical dilatation assessment in labor.

Conclusion

This study points to an improvement in cervical dilation measurement using a dilation simulator when combined with a visual tool for objective measurement. The increase in the number of hits by students in cervical dilation assessment in dilation simulators was greater with the use of DVV both simultaneously and sequentially. The use of a DVV increased the probability of hits by students in cervical dilation assessment in dilation simulators.

Collaborations

Araújo NM, Ochiai AM, Camargo JCS, Urasaki MBM, Albuquerque RS and Tuesta EF collaborate with the study design, data analysis and interpreta-

tion, article writing, relevant critical review of intellectual content and approval of the final version to be published.

References

1. Brancadoro M, Tognarelli S, Fambrini F, Ragusa A, Menciassi A. Devices for measuring cervical dilation during labor: systematic review and meta-analysis. Obstet Gynecol Surv. 2018;73(4):231–41.
2. Buchmann EJ, Libhaber E. Accuracy of cervical assessment in the active phase of labour. BJOG. 2007;114(7):833–7.
3. Swaminathan G, Parulekar SV. Does simulation training improve the accuracy of vaginal assessment of labour progress?. Cureus. 2021;13(7):e16089.
4. Nitsche JF, Knupp RJ, Tooze JA, Sun CH, Jin S, Brost BC. Using simulation to define the learning curve for the digital cervical examination. Obstet Gynecol. 2019;134 Suppl 1:1S–8S.
5. Nitsche JF, Goodridge E, Kim SM, Wong T, Brost BC. Evaluation of the patterns of learning in the labor cervical examination. Simul Healthc. 2019;14(6):378–83.
6. Martin EL, Firman B, Berghella V. Novel device vs manual examinations for the measurement of cervical dilation in labor: a randomized controlled trial. Am J Obstet Gynecol MFM. 2021;3(3):100328.
7. Gamboa Mora MC, Vera-Monroy SP, Mejía-Camacho A, Guerrero Rueda WJ. Perception channels and cognitive styles: opponents, followers or learning allies?. Heliyon. 2021;7(2):e06242.