

An Artificial Intelligence-Assisted Innovative Product in Labor Follow-Up: The Electronic Touch and Partograph Device

Abstract

Background: Vaginal examination is a practice that is one of the approaches to assessing women's health and that women experience numerous times throughout their lives. This examination is considered to be the most important parameter that is highly preferred by health professionals during the labour process and is especially necessary in the monitoring of the childbirth process.

Aim: This study aimed to enable performing vaginal examination where labor follow-up (pelvic structure's suitability for labor, cervical dilatation, presentation and position of the fetus, and the release of amniotic fluid) is made in obstetrics, and partograph, which is the map of the progress of pregnancy, on the electronic medium.

Methods: A new device was planned to improve the system, increase the comfort of the patient, develop a device for enhancing the privacy of pregnant women during labor and minimizing the risk of infection in terms of health professionals, and to increase the effectiveness of labor follow-up with an artificial intelligence-assisted innovative device. A literature review was performed and the electronic touch and partograph device, considered a new invention, were designed. The drawing and design processes of the device were carried out by the researcher. Then, patenting processes and prototyping processes were conducted (Patent Number: TR 2017 08739 B).

Results: Manual vaginal touch often performed in labor follow-up increases the risk of infection both for pregnant women and health professionals. In this study, which was conducted based on these requirements, the research and development processes of an artificial intelligence-assisted innovative product that has yet to be used in Türkiye and the world and that enables electronic conduct of labor follow-up in obstetrics.

Conclusion: Considering the results of the Research & Development (R&D) process, it was determined that an innovative product that is safe both for pregnant women and health-care personnel, supports patient and employee safety, and maintains the effectiveness of labor follow-up was created.

Keywords: Artificial intelligence, innovative device, partograph, labor, touch

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Introduction

Today, innovations and changes in the health system have a direct impact on human life and quality of life. Innovation is the process of transforming new or existing knowledge into a commercial benefit.^{1,2} Health sector is among the areas where innovation is used very frequently. Hospitals, as the place where health services are provided, should exhibit innovative approaches to adapt to changes, sustainability, and better respond to the needs of patients and health professionals.^{3,4}

In health institutions, nurses are the most competent health professionals who apply innovations to the individual/family and society, they serve and play a role in delivering them to the society. Therefore, it is important that nurses take an active role in the innovation process and develop themselves in innovative studies.⁵ Especially in recent years, nurses have been more actively using innovation process roles such as identifying problems, developing solution-oriented innovative ideas, documentation, realizing innovative products, and promotion in service delivery.⁶

As in all areas of nursing, innovation is necessary in the field of women's health nursing. Innovation in women's health nursing has a multidimensional characteristic. In this context, in addition to pregnancy, labor, and newborn care, all stages in the processes of

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women's life periods are also included in the concepts of health and illness. Women's health nurses undertake a number of roles such as health protection, health promotion, research, education, counseling, and advocacy within their holistic roles.^{7,8}

In this study, which was carried out by taking into account the importance of innovative approaches in Women's Health Nursing, the Research & Development (R&D) process of an innovative product that enables vaginal touching and partograph to be performed electronically in labor scan follow-ups was evaluated.

Vaginal examination is a practice that is one of the approaches to assessing women's health and that women experience numerous times throughout their lives. This examination is considered to be the most important parameter that is highly preferred by health professionals during the labor process and is especially necessary in the monitoring of the childbirth process. For vaginal childbirth to occur during the labor process, the mother's cervix must be dilated up to 10 cm from the closed position. In obstetrics, vaginal examination is frequently used to determine the onset of the active phase of labor, to assess the dilatation and effacement of the cervix, the suitability of the pelvis for delivery and the position of the fetus, and to monitor the course of labor.^{5,7}

In many studies conducted on the labor process, it has been determined that vaginal examination is repeated in short periods of time such as 2 hours and that this examination is performed many times during the palpation process. It is well known that as the frequency of examination increases, it brings many risks along with it, and the risk of chorioamnionitis in particular increases. It was found that frequent vaginal examination not only resulted in the risk of infection in women but also had a negative effect on the notion of confidentiality.^{2,7}

Nowadays, labor follow-up (suitability of the pelvic structure for labor, cervical dilatation, presentation and position of the fetus, and break of amniotic fluid) is controlled through manual vaginal examination (touching). The obtained labor data are manually recorded by health-care professionals on the partograph form, which is a graphical record showing the progress of labor and indicating the maternal and fetal status. Thanks to the partograph, the mapping of the labor is done. The use of partograph in palpation follow-up is very important as it facilitates the follow-up of the labor process and provides the opportunity for early intervention in risky situations.^{2,7}

The manual vaginal touch, which is frequently performed in the follow-up of labor, poses a risk of infection for both pregnant women and health-care professionals. In addition, vaginal examination and subsequent manual partographs pose practical challenges for health-care professionals and lead to losses in terms of labor force and time. The electronic touch and partograph device, developed within the scope of all these requirements, enable the follow-up of labor in obstetrics (suitability of the pelvic structure for childbirth, cervical dilatation, presentation and position of the fetus, and break of amniotic fluid) and the partograph, which is a map indicating the course of pregnancy, to be performed electronically. Within the scope of this article, the R&D process of an innovative product "Electronic Touch and Partograph Device" is discussed.

Methods

Innovation is a process that enables new creative ideas or inventions to be adapted and applied to economic fields, to be presented

to the market and to be transformed into value-creating outputs. This process consists of 5 successive stages from idea to product. In the development of an innovative product, there are steps such as defining the problem, developing the product idea, conducting the research process, making visual drawings of the product, starting the prototype process, documenting (patent or utility model), realizing the product, creating a brand and promotion.^{2,5}

In this study, the R&D processes of an innovative product were evaluated based on the steps of the innovation process. The study was carried out between 2016 and 2020. The challenges encountered today (Figure 1) were taken into consideration in the development of the Electronic Touch and Partograph Device (Figure 2), which is an innovative invention in its field. The following steps were pursued in the innovation processes of the Electronic Touch and Partograph Device.

Ethical Aspect

The necessary permissions were obtained for the study and the study was evaluated and approved by the Ethics Committee of Zeynep Kamil Women and Children Diseases Training and Research Hospital (Approval No: EY.FR.22-127, Date: 24.06.2020). The study was conducted in accordance with the Declaration of Helsinki. A confidentiality agreement has been made with the engineering teams collaborated with in terms of product safety in R&D processes.

Discussion

Today, within the scope of changing and developing roles, women's health nurses need to be a good observer, determine the needs of patients, demonstrate a holistic approach, and actively use their innovative roles to improve service processes, as in other nursing fields.^{5,9}

Today, it is observed that women's health nurses exhibit active roles in innovation and entrepreneurship in addition to their professional roles. Especially during the birth process, innovative products developed by pregnant women to increase their satisfaction with the service and quality of healthcare are increasing. The Electronic Keypad and Partograph Device, which is an example of these innovative products, enable palpation follow-up in obstetrics (suitability of the pelvic structure for delivery, cervical dilatation, presentation and position of the fetus, and arrival of amniotic fluid) and partograph, which is a map of the course of pregnancy, to be performed in digital environment. Within the scope of this article, the R&D process of an innovative product "Electronic Keypad and Partograph Device" is included in the study.

Today, the place and necessity of many routine interventions in normal labor follow-up processes are being questioned again.¹¹⁻¹³ There is no standardized approach to vaginal palpation, which has an important place among these interventions and is frequently used in labor monitoring.¹⁴

Vaginal examination is an extremely important practice to have information about the birth process, to monitor the progress of birth and to detect and intervene in risky situations at an early stage. However, the fact that the vaginal examination is not performed with due care during the application and is performed at frequent intervals causes women to experience feelings of fear, pain, discomfort, anxiety, and embarrassment, leading to a decrease in birth satisfaction. In addition, these negative experiences cause women to avoid subsequent examinations and delay diagnosis and treatment processes.¹⁵⁻¹⁹

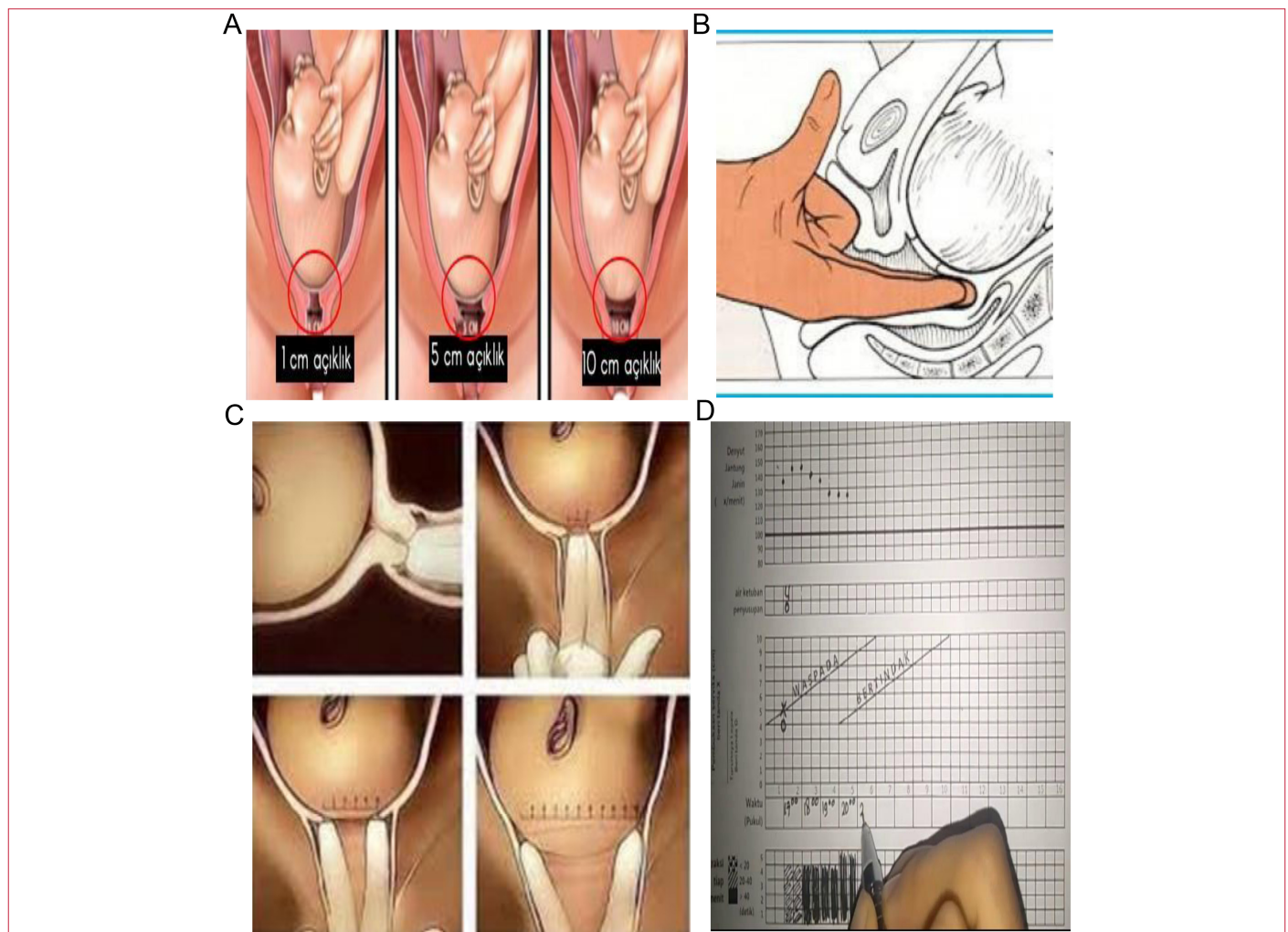


Figure 1. Today, Manual Palpation Follow-ups. (A) Cervical patency control in labor, (B) Cervical patency control in labor, (C) Measurement of cervical patency by vaginal palpation in labor, and (D) Recording of palpation measurements on the partograph form.

In a study conducted by Shepherd and Cheyne to determine the reasons for and frequency of vaginal examination at childbirth, it was found that almost 70% of health professionals performed vaginal examination at intervals of more than 4 hours.²⁰ Frequent vaginal examinations are not recommended because they disrupt the routine process of labor, cause women to have negative birth experiences and risk infection.²¹

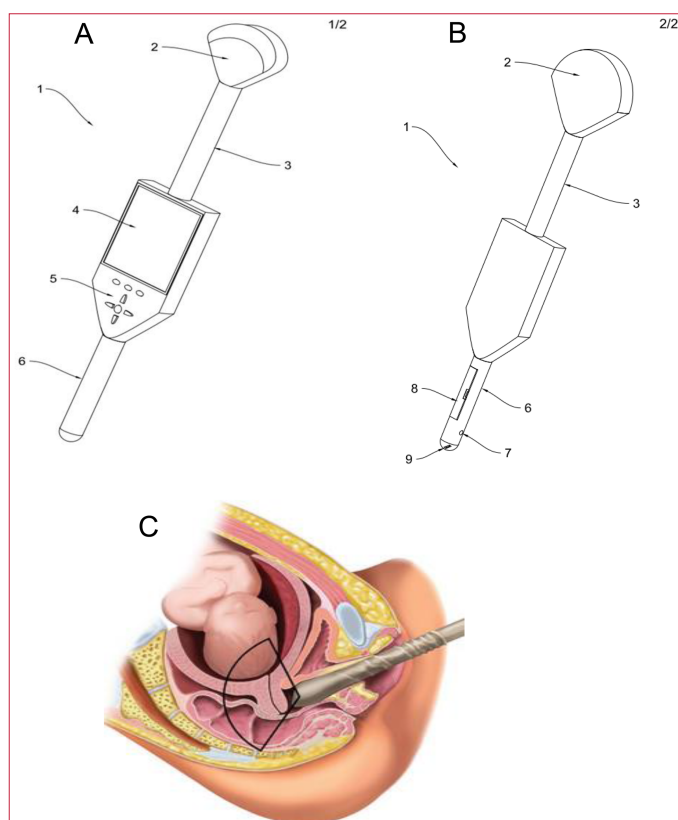
In World Health Organization'S (WHO) Recommendations for Intrapartum Care for a Positive Childbirth Experience, it is recommended to routinely perform vaginal examinations at 4-hour intervals in low-risk women to assess the progress of the childbirth.^{21,22}

In 2 different studies on this subject, it was found that women who had not experienced labor before were more uncomfortable with vaginal touch than those who had given birth.^{23,24} In another study, it was found that women felt pain and embarrassment during vaginal examination.²⁵ In different studies, it was determined that women described vaginal touching as "a necessary but unpleasant, uncomfortable, embarrassing, and painful situation." In addition, it was found in the studies that the most important feature required was

that the person performing the vaginal examination should be a woman and a doctor.²⁶⁻³⁰

Partograph is a frequently used application that allows the birth process to be displayed graphically on paper and birth abnormalities to be easily detected. The American Women's Collage recommends that all midwives use a partograph in labor assessments.³¹ Swedish researchers believe that regular partograph use is responsible for the low infant mortality rate.³¹

In the literature, it is stated that inadequate training on the use of the partograph is effective in the ineffective use of the partograph.³² In the study conducted by Modares et al, it was found that midwives (69.8%) had insufficient knowledge about partograph. In a different study, it was determined that the training given on partograph was effective.^{33,34} In 1 study, the rate of partograph use by health professionals was found to be 69.9%.³⁵ In another study, it was found that the rate of partograph use was low, and that there were difficulties especially in terms of the fact that the application was manual and its use required knowledge and time.¹¹ Literature reviews reveal the necessity of training for healthcare workers to use the partograph



NO - PART NAME

1. Electronic touch and partograph device
2. Sensor head
3. Header handle
4. Screen
5. Keypad
6. Grip handle
7. Electricity connection
8. Battery compartment
9. USB

Figure 2. Innovative Product: Electronic keystroke and partograph device features. (A) Innovative device front view, (B) Innovative device rear view, and (C) Innovative device implementation.

correctly and the need for innovative applications that will facilitate partograph application.

Avoiding unnecessary interventions is of great importance for women to have positive birth experiences and to increase their satisfaction. Therefore, women's health nurses and midwives have very important responsibilities in the management of the birth process. In this context, it is important to pay attention to privacy during vaginal examination, to follow routine procedures, to take into account women's experiences, to take innovative approaches.³⁶ While performing vaginal examination, women's health nurses and midwives should provide women's privacy, encourage them, provide effective and correct examination, support the holistic birth process, and take part in innovative approaches to improve the quality of care.³⁷

The electronic touch and partograph device, which has been developed considering the above-mentioned problems in the childbirth process, are an innovative product that enables vaginal examinations in obstetrics, where labor follow-up is performed, and the partographs, which are the maps of the course of pregnancy, to be performed electronically. The fact that all examinations are carried out electronically, not manually, with a device with a patient-based recording feature, and that the records kept can be transferred to the computer environment will be a very comfortable and effective practice for both patients and health-care professionals. Cervical findings (dilatation, effacement, in other words, the amount of opening of the cervix), pelvic findings (pelvic diameter measurement), fetal findings (presentation and position), and amniotic findings (break of amniotic fluid, fluid characteristics: Bloody, meconium, normal, etc.) obtained by the artificial intelligence-supported sensor head will be transmitted to the screen of the device and thus, the health-care professionals will be informed about all the criteria of the labor follow-up. In addition, the above-mentioned findings are recorded in the built-in memory of the electronic touch and partograph device on a patient basis. The electronic touch and partograph device, which constantly compares the recorded data with the actual data, warn the health-care professional with a warning and alarm system in an abnormal situation. The above-mentioned warnings can also be notified to the user through the screen.

Conclusion and Recommendations

When the results of the R&D process of the electronic touch and partograph device were evaluated, it was determined that an innovative product was created that was safe for both pregnant women and health-care professionals, supporting patient and employee safety, and ensuring the effectiveness of the labor follow-up.

The possible benefits that the electronic touch and partograph device will provide if it is commercialized, introduced to the market and actively used in service processes are as follows:

- It will be ensured that the partograph, which is a map of labor follow-up and the course of pregnancy in obstetrics, is performed in a digital environment,
- The device has a memory feature that allows the labor follow-up and recording of 50 patients simultaneously. All touch findings of the patient during the labor follow-up process will be recorded on the device,
- In case of deviations from normal, health-care professionals will be informed with a patient-specific warning system and early intervention will be provided and a decision support system will be created,
- The recorded information obtained from pregnant women can be transferred to the computer if desired, and online partographs can be created on a patient basis, and digital patient records will be created by integrating patient-based palpation follow-ups with the HIS system,
- The risk of infection will be prevented by attaching sterile patient-specific covers to the probe and changing them when switching from patient to patient during device use,
- With its ergonomic structure and user-friendly features, an innovative product that allows time management for health-care professionals, improves the quality of the service process, and prevents the risk of infection can be achieved,
- Satisfaction of pregnant women will be increased by ensuring patient confidentiality and comfort.

- With the developed Tusematik Device, it will be ensured that labor follow-ups will be carried out more safely, within the framework of standards, holistically, in line with the targets of a healthy mother and a healthy baby.

Ethics Committee Approval: The study was approved by the Ethics Committee of Zeynep Kamil Women and Children Diseases Training and Research Hospital (Approval No: EY.FR.22-127, Date: 24.06.2020).

Informed Consent: Verbal/Written informed consent was obtained from the patients/patient who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

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