Research Article

Virtual Reality, Fear of Pain and Labor Pain Intensity: A Randomized Controlled Trial

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Abstract

Background: Labor and delivery are physiological conditions that occur due to the contraction of the smooth muscles of the uterus. Labor pain is one of the most severe pains that anyone can experience, and its control is one of the most important goals of health care.

Methods: This study was performed on 130 healthy pregnant women who had gestational ages of 37 to 40 weeks and were randomly assigned to the intervention and control groups using the closed envelope technique. Then a virtual reality (VR) headset containing a game was provided to the study subjects in the intervention group. The Harman Fear of childbirth questionnaire and visual analog scale (VAS) were completed at different times across labor according to the study protocol. The minimum time for using the headset was 20 minutes until the end of the first stage of labor. Data were analyzed using the chi-square test, independent *t*-test, and repeated measures test via SPSS software version 20.

Results: The results showed a significant difference in pain score between the study groups. Despite expecting increasing pain intensity with labor progression, participants in the VR group reported less pain intensity and fear of labor pain compared to control subjects (F = 8.18, P < 0.05, between four and ten cervical dilatations).

Conclusions: Virtual reality interventions can be regarded as a new non-pharmaceutical strategy to control labor pain and fear of normal vaginal delivery in pregnant women.

Keywords: Virtual Reality, Labor Pain, Fear of Childbirth

1. Background

Pregnancy is a physiological phenomenon, and its end, childbirth, is one of the divine gifts for the reproduction of the human race on earth throughout history (1). From one point of view, childbirth is a spontaneous process without any need for external interventions, which has been in natural practice for many years with amazing benefits for both the mother and the child (2). On the other hand, it is considered a medicalized process accompanied by fear, anxiety, and even fear of death. So, it can be considered a critical experience in life (3).

Although the cesarean section has played an important role in reducing maternal and fetal mortality and complications in the last century, a dramatic increase in the rate of cesarian has led to notable concerns (4). According to the best of our knowledge, the most important reason for women to choose cesarean section as the preferred method for giving birth to a child is the fear of labor pain. (5). As a matter of fact, women believe that natural delivery is a long and painful experience (6). In this regard, a variety of pain relief methods have been employed to create a positive experience of childbirth for women (4). Among these methods, neuraxial blockade plays an important role in pain control in women going through the delivery process (7, 8). Considering advances in childbearing care and creating a positive experience of childbirth, specific considerations should be planned for every pregnant woman. One of the main items of a birth plan is pain control. Nowadays, we have a lot of options for managing labor pain, from pharmacotherapies, patient-controlled analgesia (PCA), and nitrous oxide to acupuncture, hypnosis, yoga, hydrotherapy, massage, relaxation techniques, and transcutaneous electronic nerve stimulation (TENS) (4-7, 9). Among these methods, the use of non-pharmacological pain control methods is more popular due to their fewer side effects (7). As a new technique, virtual reality (VR) can control pain through distraction.

Recent literature has reported the successful use of VR in some painful procedures ([8-13](#)). Via wearing VR glasses, a women's brain is bombarded with input information which limits receiving pain signals ([14](#)).

2. Objectives

Along with technological advances aiming to increase the quality of childbearing and delivery, this study, in a pioneering task, intended to investigate the effects of using VR technology on the intensity of labor pain and fear of pain among laboring primiparous women.

3. Methods

In a randomized, controlled, single-center clinical trial, we randomly selected 130 primiparous women who were on documented labor based on cervical examination and regular uterine contractions. Other main criteria were age between 18 and 42 years, gestational age of 37 to 41 weeks, having a singleton pregnancy with vertex presentation, and having no history of chronic medical conditions or pregnancy complications. Women with a diagnosis of migraine, headache, dizziness, motion sickness, epilepsy, psychiatric disorders, visual or auditory disabilities, and a history of cesarean section were excluded.

This study was approved by the Research Ethics Committees of the School of Nursing and Midwifery & Rehabilitation, Tehran University of Medical Sciences (IR.TUMS.FNM.REC.1399.1567) and registered at Iranian Registry for Clinical Trials (NO: IRCT20200808048334N1). The study was conducted in the Emam Khomeini Hospital of Mahabad city, South Azarbaijan province, Iran, from February 2019 to January 2021.

We used Samsung Gear VR Headset streaming a game containing a pleasant sound (flow of water) simulating sea shore. In the virtual environment of the game, the woman felt herself in a boat floating on water, and at the same time, heard the pleasant sound of water. As soon as the game started, with eye movements into the sky, the woman chose the items related to the baby from the objects that were seen. If the choice was correct, the sound of the baby laughing was heard, when she could enter another level. Before the intervention, the device's instructions were explained to the participants. The Harman Maternity Fear Questionnaire was completed twice during the study (at the time of admission and two hours after delivery) for all participants.

The laboring women who were enrolled in the VR group first wore the headsets in early labor (Cervical dilation = 4 cm) for 20 minutes. The minimum time to use the headset was 20 minutes until the end of the first stage of labor, where the participants in the intervention group had no limitation in using the headset in terms of frequency and duration. In the control group, participants did not wear VR headsets but received our standard care during labor. Women were excluded from the study if they refused to wear the headset throughout the study for at least 20 minutes. Also, candidates for cesarean section were excluded. All midwifery care, from admission to delivery and discharge, was carried out by a midwife who was in charge of the patient. The researcher was solely responsible for conducting the research steps, such as delivering the headset and collecting the questionnaires.

3.1. Study Tools

In this research, we used the Harman Maternity Fear Questionnaire and VAS for measuring fear and pain, respectively. The first questionnaire was completed twice during the study (at the time of admission and two hours after delivery) for all participants. Simultaneously, after midwives confirmed 4, 6, ,8, and 10 cm cervical dilations based on clinical examinations, the VAS was immediately completed by the participants of both groups at each point. After collecting the data, statistical analysis was performed to compare outcomes between the groups.

4. Results

The baseline data of laboring women randomized to either the VR group or the control group have been shown in [Table 1](#). There was no significant difference between the two groups in terms of age, gestational age, and gravida rank ($P > 0.05$ for all comparisons) based on the chi-square test.

As seen in [Table 2](#) and based on the Repeated Measures test at the 0.05 level of significance, there was a significant difference in fear of labor pain between the two study groups at all points of comparison (F = 91.26, $P < 0.001$). Also, as labor progressed, pain intensity (i.e., rank) increased in the control group.

According to [Table 3](#) and the results of the independent *t*-test at a statistical significance of 0.05, there was a significant difference in pain intensity between the two study groups at the cervical dilatations of six to 10.

Although there was no significant difference between the two groups at early labor, the difference became prominent as labor proceeded.

5. Discussion

Pain has always been one of the most disturbing human experiences, for controlling of which many medical

Table 1. Characteristics of the Study Participants [a]

Variables	VR Group	Control Group	P-Value
Age, y			0.77
18 - 20	17 (26.2)	19 (29.2)	
21 - 25	29 (44.6)	25 (38.5)	
25 <	19 (29.2)	21 (32.3)	
Gestational age, week			0.84
37 - 38	19 (29.2)	22 (33.8)	
39 - 40	26 (18.2)	25 (38.5)	
41	20 (52.6)	18 (47.4)	
Number of gravida			0.66
1	53 (81.5)	51 (78.5)	
2 ≤	12 (18.5)	14 (21.5)	

[a] Values are expressed as No. (%).

interventions have been introduced. Virtual reality is a developing technology that has recently attracted the attention of healthcare practitioners. Since this is a novel approach, limited data are available regarding its benefits in controlling labor pain.

According to our results, VR had a significant alleviating effect on pain intensity. During labor, pain increases with the progression of the process, where poor pain management can decrease the efficacy of therapeutic interventions. Maghalian et al. reported a negative correlation between satisfaction and pain during the second stage of labor (15). Consistently, we found that the participants in the VR group felt milder pain at each point of evaluation. In line with this finding, Gür and Apay suggested that AR could be a viable pain controlling technique during the active phase of labor. Although they used VR as a cognitive behavioral technique, underlying mechanisms seem to be the same (16). Another study by Ebrahimian and Rahmani Bilandi investigated the effects of VR in comparison with chewing mint gum on pain intensity during the first stage of labor. In addition to pain, they addressed childbirth satisfaction, and their results showed that both methods were able to reduce pain and lead to a pleasant delivery for women, ultimately increasing their satisfaction (17). Frey et al. evaluated the benefits of VR use during episiotomy repair and reported less pain in the intervention group (18). In this study, the women stated a reduction in the perceived pain during episiotomy. Moreover, Carus et al. (19), Frey et al. (18), and Wong et al. (20) assessed the effects of this technique on pain during the wound dressing process, all of which reporting that VR could play a significant role in controlling pain by distracting women from the stressful space of childbirth, leading to perceiving less pain. All

these studies consistently confirmed the effectiveness of this method in pain reduction.

Regarding the effects of VR on fear of pain, our results showed a significant difference between the study groups after the intervention. Fear of pain is an important factor that directly affects the choice of delivery method. So, most women who selected elective cesarean section were overwhelmed with fear of labor pain. In order to encourage these women to choose natural delivery, effective interventions can be those reducing the fear of pain. Due to the importance of the topic, many studies in recent years have addressed this issue, investigating the effects of VR as one of the effective methods. Frey et al. evaluated the implications of VR on fear of normal vaginal delivery as a variant of tokophobia and reported similar results (18). Also, Hajesmaeel-Gohari et al. and Ebrahimian and Rahmani Bilandi reported similar results (17, 21). Wu et al. and Shurab et al. also showed the efficacy of this technology in different settings (epidural anesthesia and episiotomy repair, respectively) (22, 23). Hajesmaeel-Gohari et al. showed that the use of VR and the presentation of three-dimensional images of the fetus were associated with a significant reduction in the fear and salivary secretion of cortisol in pregnant mothers (21). In this regard, the use of VR was shown to allow mothers to distance themselves from the stressful environment and labor and delivery and become more relaxed and less anxious. So, fear of pain seems to be positively influenced by this technology and causes pregnant women to find themselves at a more pleasant position during labor and recruit appropriate physiological responses to cope with stress and fear.

Table 2. The Comparison of Fear of Labor Pain Between the Two Study Groups at Different Cervical Dilatations

Cervical Dilatation, cm	VR Group, Mean ± SD	Control Group, Mean ± SD	Test Results
4	28.03 ± 3.15	27.23 ± 3.59	
6	29.81 ± 3.91	32.15 ± 2.80	F = 91.26; P < 0.001
8	32.25 ± 3.92	34.80 ± 3.27	
10 (complete dilatation)	32.51 ± 3.88	38.60 ± 4.72	
Test result	F = 8.18; P < 0.001	F = 1.33; P < 0.001	F Group × Time = 88/29; P < 0.001

Table 3. The Comparison of Pain Intensity Between the Two Study Groups at Different Cervical Dilatations

Cervical Dilatation (cm)	VR Group, Mean ± SD	Control Group, Mean ± SD	Test Result
4	6.33 ± 2.64	6.89 ± 2.35	T = 1.96; P = 0.16
6	6.81 ± 2.53	7.80 ± 2.16	T = 4.49; P = 0.01
8	6.85 ± 2.51	7.93 ± 2.29	T = 2.11; P < 0.001
10 (complete dilatation)	7.34 ± 2.35	8.35 ± 1.97	T = 4.59; P < 0.001

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