Efficacy of Virtual Reality Application as a Distraction for Primiparity Women at 1st stage of Labor on Pain and Anxiety Control

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Abstract

Background: Virtual reality is a new and modern technology; Virtual reality is significantly safe and beneficial in reducing pain and anxiety during labor. **Aim** was to explore the efficacy of virtual reality application as a distraction for primiparity women at 1st stage of labor on pain and anxiety control. **Design:** A quasi-experimental design was utilized to fulfill the aim of this study. **Setting:** the labor unit in (obstetrics & gynecology department) at Benha University. **Sample:** A purposive sample that fulfill the inclusion criteria **[**Total 220 primipara were equally divided into two groups (control group: 110 primipara and study group: 110 primipara)**]**. **Tools:** There are four main tools; interviewing questionnaire sheet (sociodemographic data and obstetrics history), labour observational sheet through partograph, pain and anxiety assessment scales (Visual Analog Scale and Anxiety Rating Scale) and modified maternal satisfaction questionnaire. **Results**: There was a highly statistical significant difference related to labor pain and anxiety during the first stage of labor. Moreover, there was highly statistical significance difference related duration of the different stages of labor. The majority of women were satisfied with virtual reality application. **Conclusion:** Virtual reality had a positive effect on pain and anxiety levels during the first stage of labor. **Recomendations:** Virtual reality is recommended as an alternative non-pharmacological therapy, which can be applied in maternity hospitals for effective effect in labor pain and anxiety management.

Keywords: Anxiety, Labor Pain, Maternal satisfaction, Virtual reality.

Introduction

Labor is a series of events that take place in the genital organs to expel the-viable products of conception out of the uterus through the vagina. Labor is a- clinical process characterized by expulsion of fetus and placenta after 20 weeks and over 500 g with contractions causing cervical dilatation, effacement and gradually increasing in severity ***(Sakala, 2020)***.

The process of labor is divided into four stages. The first stage of labor is the longest and involves three phases namely latent, active and transition. Latent phase begins with the onset of regular uterine contractions until cervical dilatation. The- active phase occurs when cervical dilatation is at 4 to 7 cm. The transition phase occurs when dilatation is at 8 to 10 cm. The second stage starts when cervical dilatation reaches 10 cm and ends with delivering of baby. The third stage or the-placental stage starts after the delivery of the baby and ends with the delivery of the-placenta ***(Sel, 2019).*** Finally, the fourth stage is the first six hours immediately following the labor which emphasize the importance of the close maternal observation needed at this time ***(Dutta & Groves, (2019).***

Labor pain is an unpleasant sensation that is usually localized to the back and the abdomen and is the most acute pain of human body. Labor pain affects physiological, behavioral, sensory and cognitive responses. Pain is influenced not only by the physiological and anatomical factors, but also by psychological and socio-cultural factors. The most important goal of labor pain is to mobilize woman to cooperate with her own body during labor ***(Graber, et al., 2020).***

During labor, anxiety, fear, muscle tension and fatigue decrease the ability to tolerate pain. The anxiety experienced during labor directs women to cesarean section (CS) by their own as the anxiety reduces the self- confidence and the women feel unskilled and incompetent, so the nurses try to provide comfort in labor by

controlling and reducing pain and anxiety as a part of nursing practices. The level of anxiety increases significantly, especially in primipara. If anxiety persists, this can cause maternal and fetal hypoxia due to higher oxygen ***(Cevik & Karaduman, 2020).***

There are many interventions that nurses can implement to help reduce anxiety and promote comfort. The methods used for the management of labor pain are divided into two groups: pharmacological and non–pharmacological therapies. The pharmacological therapies as (local anesthesia, spinal anesthesia, epidural anesthesia, etc) which are offered to prevent or decrease the pain of labor is effective, but it is associated with maternal or fetal side effects ***(Noe, 2020).***

On the other hand, non-pharmacological therapies help to ensure that the labor takes place in a safe manner and facilitate a positive outcome. Non-pharmacological therapies are an ***option*** to replace analgesia during labor and to support the woman in dealing with her pain complaints includes birthing ball, reflexology, heat and cold therapy, transcutaneous electrical nerve stimulation (TENS), aromatherapy, hydrotherapy and Virtual Reality (VR). Non – pharmacological therapies not only relieve pain, but also relieve fear, anxiety, improve labor progress, minimize drug requirement, applicable, cheap and safe ***(McLaughlin & Lyons, 2020).***

Virtual Reality (VR) is a non-pharmacological therapy and a distraction intervention to provide a pleasant environment by using a computer-stimulated technique that provide a ***visual*** image with accompanying sounds by wearing a headset connected to a computer or a smartphone. This technology allays pain and anxiety by allowing individuals to hear, feel and communicate with stimuli of virtual environment as a real world ***(Linowes, 2020).***

According to the neuromatrix theory of pain, cognitive, sensory, and affective inputs as well as factors influencing those, such as attention can change pain perception and ultimately a person's response to pain. Accordingly, by engaging the cognitive resources of a person in a task by watching or playing something through VR, offering them sensory stimulation visual and auditory, or offering them positive affective experiences by enjoyment or success, limited capacity remains for the person to process or attend to pain ***(Ahmadpour, et al., 2020).***

Pain relief is one of amazing benefits of VR in medicine. VR is safe, enjoyable, effective, simplifies complex problems and situations, create interest and minimize anxiety. As a consequence, VR technology can improve patients' quality of life and satisfaction with care ***(Li, et al., 2017).***

Nurses have a critical and vital role in assessing the women's perception of pain by documenting and evaluating the pain and providing options for pain control by giving information about pain relief measures used by the hospital. In addition to, evaluating the maternal and fetal response to treatment as side effects, women's satisfaction with that treatment and modifying the plan of care when needed. Effective and competent nurses must be knowledgeable and understand maternal and fetal physiology, implications of treatment and usually try to diminish distress related to painand respond quickly to reports of pain and will believe patients' reports of pain ***(Murray & Huelsmann, 2020).***

Significance of the study

Labor pain and anxiety discourage many pregnant women from choosing vaginal and normal birth. Based on the imposition that anxiety and pain are the major factors responsible for the rising of cesarean section (CS) rate not only locally but also internationally ***(Lima, et al, 2019).*** According to WHO Suggestion that CS rate should lies between 5% and 15 % however the worldwide percentage is higher. This represents 21.1% worldwide ***(Candel, et al.,2020).*** The past decade has witnessed a sharp increase in CS rate in Egypt which estimated as 51.8 % according to Egypt Demographic and Health Survey (***Byamugisha&Adroma, 2020).***

Management of labor pain is an essential aspect of obstetric care and a major goal of intrapartum care. Although complete suppression of the labor pain is not achievable, several methods of pain relief can be utilized to decrease the level and intensity of pain and

pain ***consequences***. As labor pain has many physiological and psychological changes that are indicative of maternal pain as tachycardia, increased blood pressure, increased anxiety and stress, decreased urine output and intestinal motility, changes in mood and marked agitation ***(Lyons & McLa*ughlin, 2020)**

Virtual Reality is a non-pharmacological therapy and one of distraction techniques that replaces the real world by immersing users into a computer-generated virtual world. VR is utilizing five senses in order to focus the patient's attention on other stimuli and hence control pain in a better way. This technique can help in reducing pain, fear, and anxiety and can also be helpful with any discomfort after labor ***(Rezai, et al., 2016)***. VR is a cost – effective, safe, effective in pain and anxiety controlling, can be used as a self-management tool for pain relief and affordable ***(Tacgin, 2020).***

Aim of the study

The present study aimed to examine the efficacy of virtual reality application as a distraction for primiparity women at 1st stage of labor on pain and anxiety control.

Research Hypotheses:

- Women who apply virtual reality would have alleviated labor pain than those who don't.
- Women who apply virtual reality would have alleviated labor anxiety than those who don't.
- Women who apply virtual reality would have favorite labor (maternal and fetal) outcomes than those who don't

Conceptual definition of virtual reality:

Virtual reality (VR) refers to a computer-generated simulation in which a person can interact within an artificial three-dimensional environment using electronic devices, such as special goggles with a screen or gloves fitted with sensors. In this simulated artificial environment, the user is able to have a realistic-feeling experience.

Subjects and Method

Research design:

A quasi-experimental design was utilized to fulfill the aim of this research.

(Two-Groups, control and study). A quasi-experiment is an observational interventional analysis used without random assignment to estimate the causal effect of an intervention on the target population. Quasi-experimental study shares similarities with conventional experimental design or randomized controlled trials, but the aspect of random assignment to treatment or control is clearly missing. ***(Dinardo, 2008; Iowa State University of Science and Technology, 2020).***In a scientific study, Control groups are essential to experimental design. When researchers are interested in the impact of a new treatment, they randomly divide their study participants into at least two groups: The study group (also called the experimental group) receives the treatment whose effect the researcher is interested in.The control group receives either no treatment, a standard treatment whose effect is already known, or a placebo (a fake treatment) ***(Thomas, 2020).***

Setting:

This study was carried out among primiparity women in the labor unit (obstetrics &gynecology department) at Benha University Hospital. Benha University Hospital is the main setting and located in Benha City at Qalioubia Governorate. This particular setting was chosen because it is main hospital providing care for women with different social backgrounds and high risk women. Also, it's a clinical training setting for nursing students in the Faculty of Nursing. This hospital started to provide care since its opening in 1981; it provides free and economical service to all patients. The hospital receives large numbers of women each month who seek care for follow up during pregnancy from different areas (urban & rural area). Almost the hospital receives about 500 primigravida women annually who seek care during pregnancy (from official records).

Sample:

Sample type: A purposive sample with the following inclusion and exclusion criteria: primiparity women with intact membranes, free from medical or obstetrics complications,

women aged 18-35 years with gestational age between 37-42 weeks, women in active phase of labor and accept the VR intervention. Moreover, any women deviated from normality was excluded from the sample.

Sample size: The total number of primiparity attending to labor unit atBenha University Hospital at (2018) was 500 primiparity women ***(Benha University Hospital Census, 2018)***. So, expected number of study subjects as calculated by the following formula was 222. But, for accuracy of statistical measurements the sample size will be 220.A total 220 women were randomly divided into two groups (control group =110 woman who received routine care and study group =110 woman who used virtual reality technology).

- n= sample.***n =N***
- N= population.
- e= margin error (0.05).

$$1+N(e)^2$$

Tools of data collection:

Four tools were used for collecting data.

Tool I- Interviewing questionnaire sheet:

It consisted of two parts:

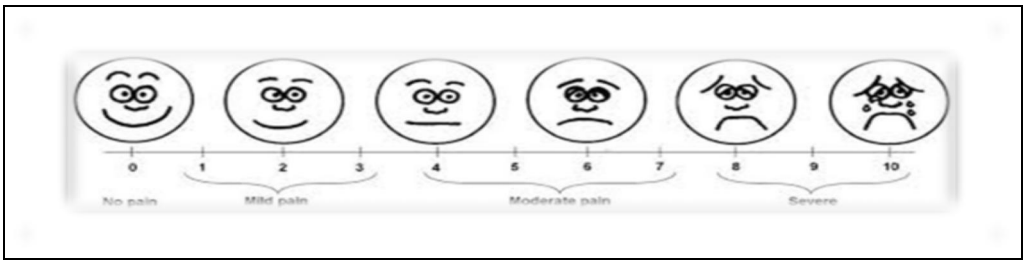
- **Part (1)** Socio-demographic data of women such as (name, age, residence, level of education, occupation, weight, height and body mass index).
- **Part (2)** Obstetrical history of women such as (last menstrual date, current gestational age, number of previous abortion and estimated delivery date).

Tool II- Labor observational sheet (Partograph):

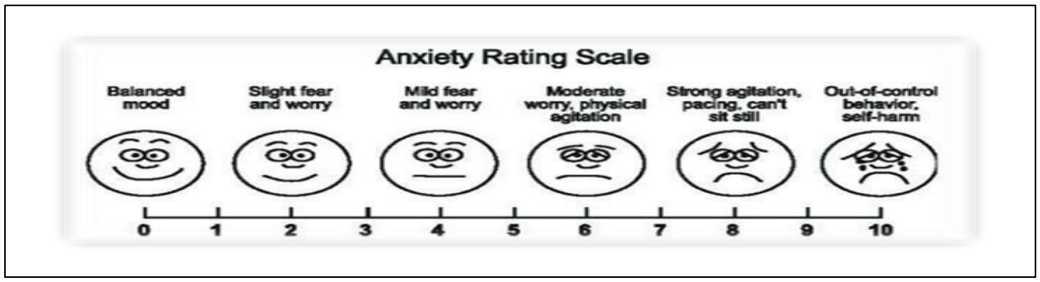
Partograph: As appointed by ***(WHO, 1994)*** is a graphic recording used to collect data related to labor progress. This tool included three main sections: Fetal condition that include (fetal heart rate, color of liquor and degree of molding), the progress of labor that include (cervical dilatation, descent of head and uterine contractions) and maternal condition that include (blood pressure, pulse, temperature and urine analysis for albumin, protein and volume).

Tool III- Scales for assessment of pain and anxiety:

Part (1) Visual Analog Scale (VAS): This was developed by ***(Hayes & Patterson, 1921)*** to assess the severity and intensity of pain experienced by the woman during labor. VAS is a straight line, the ends of which are defined as the extreme limits of the sensation to be measured from 0 (no pain) to 10 (worst pain). The VAS total scoring was divided into four main parts : the first part graded 0 which indicate no pain, the second part graded from 1-3 for mild pain, the third part from 4-7 for moderate pain and the fourth part from 8-10 for severe pain.



Part (2) Anxiety Rating Scale: This developed by ***(Bloch, 2009)*** to assess level of anxiety experienced by the woman during labor. It is a straight line, the ends of which are defined as the extreme limits of the sensation to be measured from 0 (balanced mood) to 10 (out of control). The anxiety rating scale scoring was divided into six main parts: the first part graded 0 which indicated balanced mood, the second part from 1-2 reflect slight fear and worry, the third part from 3-4 indicate mild fear, the fourth part graded 5 indicated moderate fear, the fifth part from 6-7 reflect strong agitation and the six part from 8-10 indicate out of control behavior.



Tool IV- Modified maternal satisfaction questionnaire:

This was constructed by the researcher after reviewing a related literature to assess maternal satisfaction for usability of virtual reality. It is consisted of 7 questions to obtain the outcome of questionnaire, each statement scored as the following: (3) if the response was "Highly satisfied", (2) if it was "Satisfied", and (1) if it was "unsatisfied".

Pilot study:

The pilot study was carried out. It involved ten percent of the total sample (22 primiparity women) to test the simplicity, feasibility, clarity and applicability of the developed tools, also to find out the possible obstacles and problems that might face the- researchers and interfere with data collection. Women involved in the pilot excluded from the study.

Tools validity:

The tools of data collection were thoroughly reviewed by a panel of five experts included three from obstetrics and gynecological health nursing professors and two from obstetrics and gynecological medicine to test the content validity, modifications were carried out according to the panel' judgements on clarity of sentences and the appropriateness of content.

Tools Reliability:

Reliability of tools was tested by using Cronbach's alpha coefficient test, which revealed that the tools consisted of relatively homogenous items as showed by the moderate to high reliability of each tool.

Ethical considerations:

The aim of the study explained to each woman about the purpose and benefits of the study before applying the tools to gain their confidence and trust. An oral consent was obtained from each woman to participate in the study and withdraw when she needs. The study was not having any physical, social or psychological risk on the participant. Confidentially was ensured throughout the study process and the women were assured that all data was used only for research purpose. Each study subject was informed about time throughout the study.

Field of work:

Upon obtaining official permission from director of Benha University Hospital, data was collected through four phases. The following phases were adopted to fulfill the aim of the current research: preparatory, assessment, implementation and evaluation phases.

I. Preparatory Phase:

The preparatory phase was the first phase of the research; the researchers carried out through review of local and international related literature about the various aspects of the research problem. This helped the researchers to be aware of magnitude and seriousness of the problem, and guide the researchers to prepare the required data collection tools. Tools were distributed to five experts in the field, three from obstetrics and gynecological health nursing professors and two from obstetrics and gynecological medicine, the aim was to test its appropriateness, comprehensiveness, clarity, importance and applicability. The result of the jury was done. During this phase an official approval to conduct the research was obtained by submission an official letter was obtained from the Dean of Faculty of Nursing at Benha University to the director of Benha University Hospital in order to obtain their agreement to conduct the research after explaining its purpose and get the statistical numbers of primiparity women enrolled within hospital annually.

II. Assessment Phase:

This phase encompassed interviewing the pregnant in labor unit (obstetrics & gynecology department) (in both study and control group) to collect baseline data, the researchers attended labor unit twice perweek (Mondays and Tuesdays) from 8am to 4 pm. The researcher interviewed 2 – 3 women / day until the predetermined sample size attain from women who met the inclusion criteria that mentioned firstly, at the beginning of interview the researchers greeted each woman, introduced themselves, explained the purpose and duration of the study. Women who met the inclusion criteria were identified and oral informed consent was taken to participate in the study. The data was obtained during this phase constituted as baseline for further comparison to explore the usability of virtual reality for relieving pain and anxiety for primiparity women during 1st stage of labor and its effect on labor outcomes. The control group was assessed first to avoid contamination of study between both groups and for ethical consideration.

III. Implementation Phase:

The sample was divided into two groups, the control group (group A constituted 110 women) and the study group (group B constituted 110 women). The study was started by control group and followed by the study group. Data were collected through a period of 12 months from the beginning of March 2019 to the end of February 2020 at labor unit in obstetrics and gynecological department at Benha university hospital.

Control group:

- Routine care was given to the control group by the hospital staff.
- Collecting socio-demographic data and obstetrical history using (tool I: structured interviewing questionnaire). The researchers asked questions in Arabic and recorded the answers in the sheet. This step took about (5 – 10 minutes) to be completed for each woman.
- Assessing progress of labor by using (tool II: partograph). This assessment took different periods of time to be completed for each woman.
- Pain and anxiety were assessed at cervical dilatation 4cm and at cervical dilatation 9cm of the first stage of labor.
- The pain and anxiety was assessed twice (initial assessment and repeated assessment).
  - **Initial assessment**: at cervical dilatation 4 cm and 9cm of the 1st stage of labor, level of pain assessed by using (tool III: part 1, VAS) and level of anxiety assessed by using (tool III: part 2, Anxiety Rating Scale). The initial assessment took around 5 minutes to be completed for each woman.
  - **Repeated assessment:** After 15 minutes, pain and anxiety were assessed again at the same cervical dilatation 4cm and 9cm of the 1st stage of labor. The repeated assessment took around 5 minutes to be completed for each woman.
- Assessment the progress of labor, fetal condition and maternal condition by the partogragh continued.

Study group:

- Routine care was given to the study group by the hospital staff in addition to VR intervention.
- Assessing socio-demographic data and obstetrical history using (tool I: structured interviewing questionnaire). The researcher asked questions in Arabic and recorded the answers in the schedule.
- Assessing progress of labor by using (tool II: partograph). This assessment took different periods of time to be completed for each woman.
- Pain and anxiety were assessed at cervical dilatation 4cm and at cervical dilatation 9cm of the first stage of labor. This step took about 5 minutes.
- The pain and anxiety was assessed twice: initial assessment (pre-intervention) and repeated assessment (post-intervention).
  - **Initial assessment (pre-intervention):**at cervical dilatation 4 cm and 9cm of the 1st stage of labor level of pain assessed by using (tool III: part 1, VAS) and level of anxiety assessed by using (tool III: part 2, Anxiety Rating Scale). The initial assessment took

around 5 minutes to be completed for each woman.

- **Repeated assessment (post-intervention):** Each intervention given for (10-15) minutes in order to relieving pain and anxiety. After 10-15 minutes of VR intervention pain and anxiety were assessed again at cervical dilatation 4cm and 9cm of the 1st stage of labor. For this study used VR distraction devices which allowed users to glide through 360 degrees' video and provides complete replacement which allow the person to interact with VR as if in a real world by using mobile VR in which the phone's display is used to show the twin stereoscopic views ***(Pratwi, et al, 2017).*** The repeated assessment took around 5 minutes to be completed for each woman.

- Assessment the progress of labor, fetal condition and maternal condition by the partogragh continued.
- Finally, the women in study group were assessed for their satisfaction (Tool IV) regarding usability of virtual reality.
- The VR glasses had been sterilized with alcohol while using it between women to prevent cross of infection.

IV. Evaluation Phase:

Both groups were evaluated twice at cervical dilatation (4) cm and twice at cervical dilatation (9) cm (for control group: initial assessment and repeated assessment with space time 15 minutes) and (for study group: before and immediately after intervention) as mentioned and explained previously in implementation phase.

Administrative design:

The necessary official permissions for data collection were obtained by submission an official letter from the dean of faculty of nursing to administrator of the study setting. The title and objectives of study were illustrated as well as the main data item to be covered.

Statistical design:

Data was verified prior to computerized entry. The statistical package for Social Sciences (SPSS version 20) was used for that purpose, followed by data tabulation and analysis. Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentages). Test of significance (t test, chi-square).A significant level value was considered when $p \leq 0.05$. In addition, a highly significant level value was considered when $p<0.01$.

Weakness points

Because ofVirtual Reality (VR) technology is new modality to medicine and extremely new to relieve pain and anxiety in the childbirth and labor especially in the Middle East, there was some difficulty to persuade women to accept participation in the study. Moreover, noise due to presence of relatives and internship students of the faculties of medicine and nursing.

Results

Table (1) clarifies that more than two-fifths and more than two-thirds (40.9% and 37.3%)of both study and control groups respectively in age group from (18-21 years) with a mean age of 23.55±4.33 and 24.05±4.81 years respectively. (63.6%) of the study group and (58.2%) of the control group were lived in rural area. Concerning level of education, it was cleared that less than half and half (45.5% and 50.0%) of both study and control groups respectively had secondary education. As regards occupational status, half and less than two third (50.0%% and 59.1) of both study and control groups respectively were housewife. Generally, there was no statistically significant difference between study and control groups regarding socio-demographic characteristics. That is the two groups under study homogenous.

Table (2) displays that, there were no statistically significant differences between study and control groups according to their obstetrics history ($p>0.05$). As 59.1% and 63.6% of both study and control groups respectively had gestational age from (39-41 weeks). In addition, the majority (90.9% and 86.4%) of both study and control groups respectively were primigravida. In relation to previous abortion, where the majority of them had no previous abortion.

Table (3) clarifies mean scores of the duration of labor throughout the three stages among the study and the control groups. This table indicated that, there was a shorter duration of all stages of labor among study group women with a highly statistically significant difference between study and control groups ($P< 0.001$).

Table **(4)** reveals mean scores of vital signs of

mothers among study and control groups during first stage of Labor. The results indicated that on admission there was no a statistically significant difference between study and control groups regarding vital signs measurements (P>0.05). With cervical dilatation (4-7 cm) there was a highly statistically significant difference between study and control groups regarding pulse measurement (P <0.001), while there was no a statistically significant difference between study and control groups regarding systolic and diastolic blood pressure and temperature measurements (P>0.05). With cervical dilatation (8-10 cm) there was a highly statistically significant difference between study and control groups regarding systolic and diastolic blood pressure and pulse measurement (P <0.001), while there was no a statistically significant difference between study and control groups regarding temperature measurements (P>0.05).

Table (5): illustrates mean labor pain scores among study and control groups during the first stage of labor. The result indicated that, there was no statistically significant difference between study and control groups before intervention. There was a reduction on labor pain scores during the first stage of labor (immediately after intervention, at cervical dilatation 4cm and at cervical dilatation 9cm) with a highly statistical significant difference between study and control groups (P <0.001).

This figure (1) shows that, (55.5%) of study group women had severe labor pain at cervical dilatation 9 cm as compared with (93.6%) of control group women after application of VR.

Table (6): illustrates mean labor anxiety scores among study and control groups during the first stage of labor. The result indicated that, there was no statistically significant difference between study and control groups before intervention. There was a reduction on labor anxiety scores during the first stage of labor immediately after intervention, at cervical dilatation 4cm and at cervical dilatation 9cm) with a highly statistical significant difference between study and control groups (P<0.001).

This figure (2) shows that, (3.6%) of study group women had severe anxiety at cervical dilatation 9 cm as compared with (10.0%) of control group women after application of VR.

Table (7) clarifies the pregnant women's satisfaction towards VR application. Results show that the majority of women were satisfied with VR application (Total mean score percent = 82.3%). The few percentages of women who were non– satisfied and highly satisfied with VR application (8.0% and 9.6%), respectively.

Table (1): Distribution of studied sample according to their socio-demographic characteristics (n= 220)

Characteristics	Control group n=110		Study group n=110		Chi square test	P value
	No	%	No	%		
Age (in years)						
18-	41	37.3	45	40.9	.880	>0.05
22-	38	34.5	40	36.4		
≥26	31	28.2	25	227		
Mean ±SD	24.05±4.81		23.55±4.33			
Residence						
Urban	46	41.8	40	36.4	.687	>0.05
Rural	64	58.2	70	63.6		
Educational qualification						
Pre-primary education	10	9.1	15	13.6	1.23	>0.05
Primary education	20	18.2	20	18.2		
Secondary school	55	50.0	50	45.5		
University education	25	22.7	25	22.7		
Occupational status						
Housewife	45	40.9	55	50.0	1.83	>0.05
Working	65	59.1	55	50.0		

Table (2): Distribution of studied sample according to their obstetrics history (n= 220)

Obstetrics history	Control group n=110		Study group n=110		Chi square test	P value
	No	%	No	%		
Gestational age in weeks						
37-	26	23.6	30	27.3	.505	>0.05
39-	70	63.6	65	59.1		
42	14	12.7	15	13.6		
Mean ±SD	39.56±1.35		39.40±1.44			
History of previous abortion						
No	95	86.4	100	90.9	1.12	>0.05
Yes	15	13.6	10	9.1		

A Statistical significant p ≤ 0.05A Highly Statistical significant p ≤ 0.001

Table (3): Mean duration of labor throughout the three stages among the studied sample (n=220)

Duration of labor stages	Control group n=110	Study group n=110	Independent t test	P value
	Mean ±SD	Mean ±SD		
Duration of the first stage (hours)	8.75±.56	8.38±.40	5.63	<0.001**
Duration of the second stage (minutes)	51.50±11.14	45.45±7.76	4.66	<0.001**
Duration of the third stage (minutes)	16.50±7.14	13.40±5.13	3.69	<0.001**

A Statistical significant p ≤ 0.05A Highly Statistical significant p ≤ 0.001

Table (4): Mean vital signs of studied sample during first stage of labor (n=220)

Vital signs measurements	Control group n=110	Study group n=110	Independent t test	P value
	Mean ±SD	Mean ±SD		
On admission				
Systolic BP (mmHg)	117.09±8.166	118.64±8.511	1.37	>0.05
Diastolic BP (mmHg)	68.64±6.970	70.00±6.773	1.47	>0.05
Pulse	82.32±6.121	83.45±6.402	1.34	>0.05
Temperature	37.10±.1418	37.08±.1667	1.08	>0.05
During active phase				
Systolic BP (mmHg)	121.18±5.704	120.64±6.810	.644	>0.05
Diastolic BP (mmHg)	76.45±4.806	75.36±5.100	1.63	>0.05
Pulse	82.52±4.095	78.69±6.931	4.98	<0.001**
Temperature	37.106±.0911	37.104±.1022	.209	>0.05
During transition phase				
Systolic BP (mmHg)	124.73±5.61	120.64±6.81	4.58	<0.001**
Diastolic BP (mmHg)	76.27±4.810	70.45±5.64	8.22	<0.001**
Pulse	80.77±5.89	77.84±5.26	3.89	<0.001**
Temperature	37.10±.091	37.09±.10	.766	>0.05

A Statistical significant p ≤ 0.05A Highly Statistical significant p ≤ 0.001

Table (5): Mean labor pain scores among studied sample during the first stage of labor (n=220)

Labor pain assessment	Control group n=110	Study group n=110	Independent t test	P value
	Mean ±SD	Mean ±SD		
Level of pain in active and transition phase.				
Before using VR at CD (4 cm)	5.64±1.12	5.67±1.12	-.240	>0.05
Immediately after using VR at CD (4cm)	5.72±1.15	5.14±1.04	3.91	<0.001**
Before using VR at CD (9 cm)	8.96±.54	8.97±.67	-.111	>0.05
Immediately after using VR at CD (9cm)	9.05±.67	7.45±.65	17.79	<0.001**

A Statistical significant p ≤ 0.05A Highly Statistical significant p ≤ 0.001

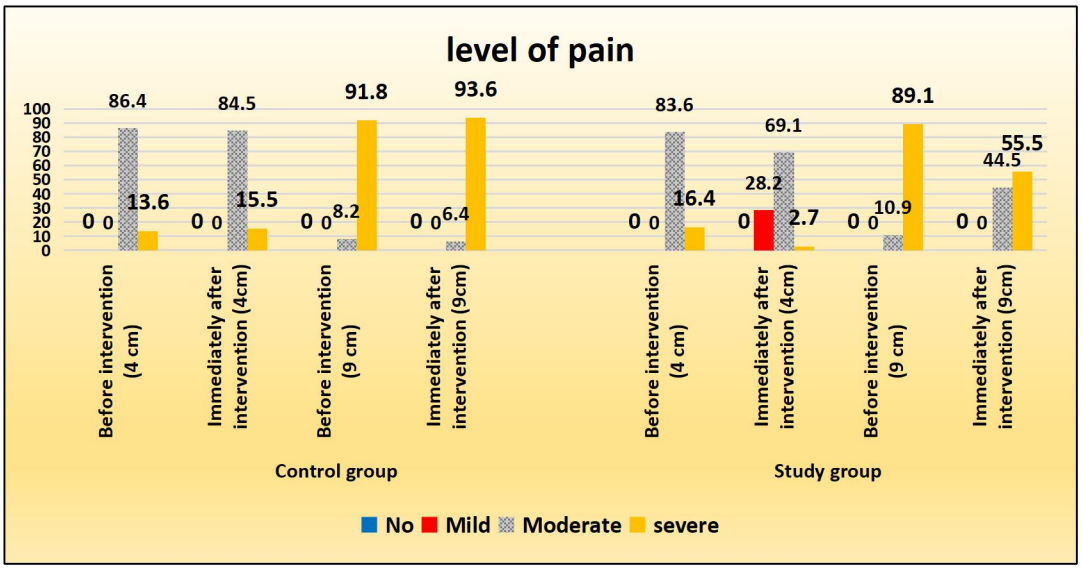


Figure (1): Level of labor pain among studied sample during the 1st stage of labor (n=220)

Table (6): Mean labor anxiety scores among studied sample during the first stage of labor (n=220)

Anxiety assessment	Control group n=110 Mean ±SD	Study group n=110 Mean ±SD	Independent t test	P value
Level of anxiety in active and transition phase.				
Before using VR at CD (4 cm)	3.68±.92	3.55±.94	1.08	>0.05
Immediately after using VR at CD (4cm)	3.68±.92	2.32±.87	11.20	<0.001**
Before using VR at CD (9 cm)	4.36±.832	4.25±.719	1.12	>0.05
Immediately after using VR at CD (9cm)	4.45±.797	2.93±.660	15.48	<0.001**

A Statistical significant p ≤ 0.05A Highly Statistical significant p ≤ 0.001

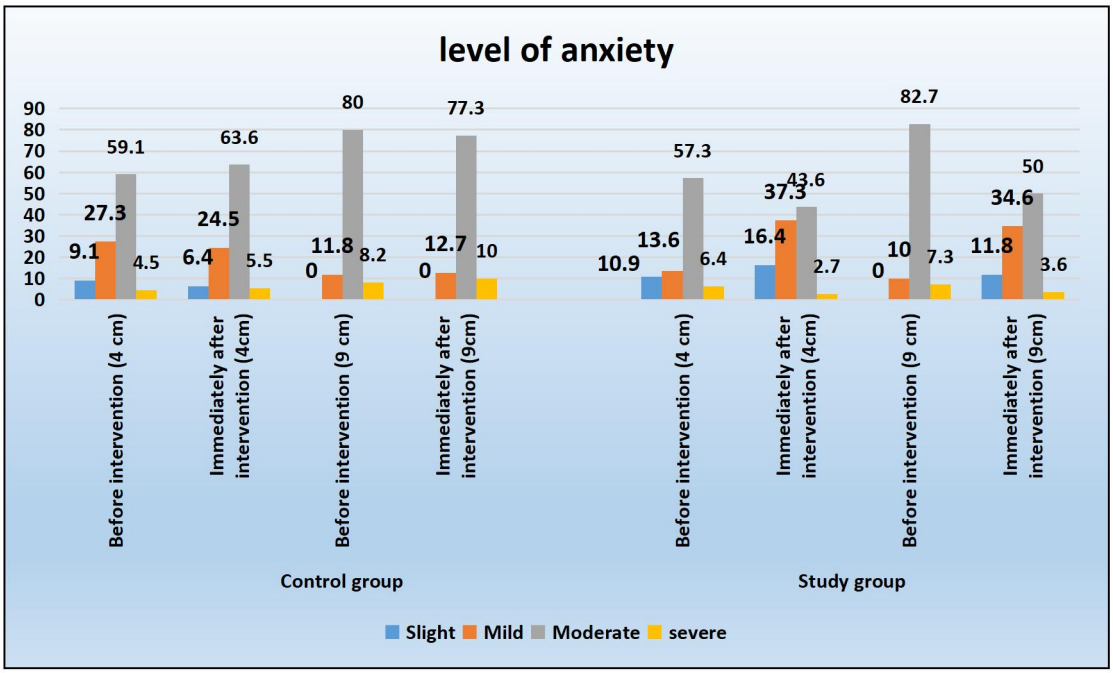


Figure (2): Level of anxiety among studied sample during the 1st stage of labor (n=220)

Table (7): Distribution of studied sample in study group according to their satisfaction toward VR application (n=110).

Items	Non – satisfied		Satisfied		Highly satisfied	
	No	%	No	%	No	%
Ease of using the application	4	3.6	95	86.4	11	10.0
Interest in the application	5	4.5	86	78.2	19	17.3
The extent of immersiveness of the application	15	13.6	91	82.7	4	3.6
Comfort of the VR headset	2	1.8	102	92.7	6	5.5
Level of discomfort of using head mounted display (HMD)	12	10.9	84	76.4	14	12.7
How likely they were to recommend the application to other women	11	10.0	87	79.1	12	10.9
Do you like to use VR application in the next labor	13	11.8	89	80.9	8	7.3
Total mean score	8.5	-	90.6	-	10.6	-
Total mean percent	-	8.0		82.3	-	9.6

Discussion:

Normal labor is a physiological process by which the products of conception are expelled from the uterus by uterine contraction and progressive cervical dilatation ***London, et al., (2021).*** Labor pain is really a side effect of a normal process not a sign of damage or injury and has many physical causes ***Simkin, (2020).*** Women who are anxious during labor have high levels of the stress hormone in the blood, which can be lead to abnormal progress through decreased uterine contractility, longer labor and abnormal fetal heart rate patterns ***Palmer & Coats, (2017).*** VR is a safe and effective non-pharmacological intervention used for control (pain and anxiety), decrease the duration of labor and promote comfort ***Gur &Apay, (2020).***

Sociodemographic characteristics can refer to age, sex, place of residence, religion, educational level, occupation and marital status that all affect labor outcome, as regards sociodemographic characteristics of both study and control groups, the present study regarding maternal age showed that more than two-fifths and more than two-thirds of both study and control groups respectively in age group from (18-22 years) with a mean age of 23.55±4.33 and 24.05±4.81 years respectively. Concerning level of education, the findings of current study cleared that less than half and half of both study and control groups respectively had secondary education. Regarding, residence, the findings of the present study showed that less than two-thirds of the study group and more than half of the control group were lived in rural area. As regards occupational status, half and less than two-thirds of both study and control groups respectively were housewife. Generally, there was no statistically significant difference between study and control groups regarding sociodemographic characteristics. There was homogeneity between the two groups regarding sociodemographic characteristics. This may be due to that studied sample was selected with purposive random sample. This was beneficial to the present study as it ensured homogeneity of two study population and generalization of the study results as well as avoiding the effect of the confounding variables.

The findings of the present study were in accordance with ***Pratiw, et al., (2017),*** who studied "The effect of virtual reality on pain in primiparity women", reported that age, education level is not show significantly different ($p > 0.05$) between intervention or control group. This may be due to that the studied sample were primipara and selected with purposive sample at a range of (18-35yrs) which is the common marriage age in the studied society culture.

The results of this study came in the same line with ***Ebrahimian&Bilandi, (2020)***, who researched "Comparisons of the effects of watching virtual reality videos and chewing gum on the length of delivery stages and

maternal childbirth satisfaction", illustrated that there was no statistically significant difference between the demographic characteristics such as education, occupation and maternal age. Moreover, ***Amiri, et al., (2019)***, who researched "The effect of distraction techniques on pain and stress during labor", revealed that there was no significant difference in sociodemographic characteristics between the two groups.

In addition to ***Gur &Apay, (2020)***, who presented "The effect of cognitive behavioral techniques using virtual reality on birth pain", revealed that there were no significant differences in demographic variables (age, educational level, occupation) between the both groups and groups show homogeneity. The results of the present study were also supported by ***Sahin&Basak, (2020),*** who studied "The effects of intraoperative progressive muscle relaxation and virtual reality application on anxiety, vital signs and satisfaction". The results clarified that there was no significant difference between the groups in terms of age and education.

As regards to obstetric history, the result of our study revealed that there were no statistically significant differences between study and control groups according to their obstetrics history ($p>0.05$). As less than two-thirds and less than two-thirds of both study and control groups respectively had gestational age from (39-41 weeks). In relation to previous abortion, where the majority of both study and control groups had no previous abortion. There was homogeneity between the two groups regarding obstetrics history. This may be due to the criteria of the purposive sample that women have no current obstetrics and medical problems or diseases and within the gestational age between (37-42wks). This was beneficial to the present study as it ensured homogeneity of two study population and generalization of the study results as well as avoiding the effect of the confounding variables.

The results of the study came in harmony with ***Ebrahimimani&Bilandi, (2020),*** who indicated that there were no significant differences between the groups in relation to gestational age. In addition, ***Gur &Apay, (2020)***, revealed that there were no significant differences in obstetric variables between the both groups and groups show homogeneity.

Moreover, the results of the present study matched with ***Wong, et al., (2020),*** who studied "Virtual reality reduces pain in laboring women", indicated that there were no significant differences in gestational age between the both groups ($p= 0.41$). The consensus of results for the present study with the other studies may refer to the similarity of personal characteristics of samples.

Duration of labor varies widely depending on maternal and fetal factors, including demographic, clinical, genetic factors, uterine activity, fetal lie or presentation, and number of fetus. It was also affected by many pharmacological and non-pharmacological factors. Oxytocin, pethidine, epidural analgesia and intravenous hydration are main pharmacological factors effect of labor duration. Non-pharmacological factors affect labor duration as massage, acupressure, water birth delivery, birth ball, positions and VR ***(Moghadam, et al., 2020).***

Concerning to duration of labor stages, the results of our study illustrated that there was a shorter duration of all stages of labor among study group women with a highly statistically significant difference between study and control groups ($P< 0.001$). The results of this study matched with ***Ebrahimian&Bilandi, (2020),*** indicated that there was significant difference in the length of the first active dilation (4-5) and second (dilation 7-9) phases of labor in the intervention than that of the control group. The progress of labor which reflected by a shorter duration of labor might be due to the efficient effect of VR intervention as a one of distraction techniques. This may be due to that VR don't effect negatively as some pharmacological therapies on contractions which are vital to aid cervical dilatation and fetal descent, they have an important role in helping to reduce dystopia (slow progress in labor).

Opposite to this, the results of our study in contrast to ***Amiri, et al., (2019),*** who clarified that there was no statistically significant difference to total length and duration of labor.

Painful contractions result in maternal

hyperventilation. Increases in cardiac output and vascular resistance may increase maternal blood pressure. The response of sympathetic stimulation to pain also leads to increase in levels of catecholamines which can depress the uterine activity and uteroplacental circulation which is a potential cause of fetal hypoxemia ***(Sood&Sood, 2019).***

Concerning **vital signs** of mothers among study and control groups during first stage of labor, the result of present study indicated that on admission there was no a statistically significant difference between study and control groups regarding vital signs measurements(P>0.05). With cervical dilatation (4-7 cm) there was a highly statistically significant difference between study and control groups regarding pulse measurement (P <0.001), while there was no a statistically significant difference between study and control groups regarding systolic and diastolic blood pressure and temperature measurements (P>0.05). With cervical dilatation (8-10 cm) there was a highly statistically significant difference between study and control groups regarding systolic and diastolic blood pressure and pulse measurement (P <0.001).

The result of the present study was in the same line with ***Goodier, (2020),*** who studied "Virtual reality may help relieving pain during childbirth", the study showed that there is a significantly higher heart rate in the control group. Moreover, ***Sahin&Basak, (2020)***, mentioned that there was a significant difference between the systolic and diastolic blood pressure in the VR group and control group. Furthermore, the results of the present study matched with ***Wong, et al., (2020)***, indicated that there were significant differences in post-intervention heart rate between the both groups (p=0.01). this result interpreted that the improvement of vital signs, in accordance with the Gate control theory, which suggests that, if the individual is attending to other stimuli away from the noxious stimuli, they will perceive the painful stimulus as less intense. VR intervention creates a general relaxation in the body. Following this relaxation, Therefore, there is an assumption that the women who received VR, due to reduction of their anxiety, pain and stress level, had lower blood pressure, heart rate and respiratory rate than those who did not receive it ***(Pratiw, et al., 2017)***

On the other hand, the result of the present study was in disagreement with ***Goodier, (2020),*** the results clarified that there was no statistically difference between the groups in blood pressure. Additionally, the result of the present study was in contrast to, ***Wong, et al., (2020)***, indicated that there were no significant differences in post-intervention systolic and diastolic BP between the both groups.

Pain during labor is a physiological condition commonly experienced by most maternity women that arises from psychic responses and physical reflexes. Labor pain is a subjective experience caused by uterine contractions, withdrawal and traction of uterine ligaments, lower uterine distension, pelvic floor muscles and perineum distension. So, VR is an effective method for reducing pain in the labor process ***Anita, (2017)***. The results of the current study indicated that there was a highly no statistically significant difference between study and control groups before intervention. There was a reduction on labor pain scores during the first stage of labor (immediately after intervention, at cervical dilatation 4cm and at cervical dilatation 9cm) with a highly statistical significant difference between study and control groups (P <0.001).

The result of the present study was similar to ***Pratiw, et al., (2017),*** who reported that there was a significant difference on women VR group and control group. As well as, ***Wong, et al., (2019)***, who studied "Patient reported outcomes on the use of virtual reality for pain management in labor", found that VR effective for reducing pain in women in labor.

In addition, ***Cowles, et al., (2019 a)***, who researched "Virtual reality may decrease pain during labor", showed that the average pain score before VR use was 2.74(+_ 2.73), after VR use the pain score decreased to an average of 2.35(+_ 2.67). There was a statistical difference in pain scores. Moreover, ***Wong, et al., (2020),*** found that there was a significant reduction in pain score from control and study groups.

Also, ***Goodier, (2020),*** revealed that there was a reduction in pain levels in study group than control group and illustrated that there is an average reduction in pain level of 0.52 at the end of that period, while the control group that didn't get the headsets reported an average increase in pain of 0.58.

In addition, these findings were supported by ***David, et al., (2019),*** who studied "Virtual reality analgesia in labor: The VRAIL pilot study- a preliminary randomized controlled trial suggesting benefit of immersive virtual reality analgesia in unmedicated laboring women", the results displayed significant pain reduction in the VR group. Furthermore, ***Cowles, et al., (2019 b),*** who conducted "Virtual reality for pain control during labor", found that VR has an optimal and effective use in labor pain.

Furthermore, the results of this study came in harmony with ***Amiri, et al., (2019)***, indicated that there was a significant difference in pain intensity during labor between intervention and control group. In addition, ***Gur &Apay, (2020),*** reported that there was significant difference in labor pain during the active phase of labor in intervention group than control group.

The improvement and progress in pain scores with VR intervention might be due to stimulation of visual cortex while engaging other senses. VR modulates the user's processing of nociceptive stimuli ***Wong, et al., (2020).*** In addition to, pain reducing effects of distraction through VR is the ability to transport the patient into an alternative reality leading to a slower response to incoming pain signals ***Sikka, et al., (2018).***

These findings supported the present study hypothesis (1) that was "Women who apply virtual reality will have alleviated labor pain than those who don't".

Anxiety is a major contributor to labor pain and intensifies pain perception. In addition, this can increase the pain of uterine contractions and lead to harmful effects as decrease placental perfusion and uterine muscle vasoconstriction that lead to fetal hypoxia. There are some anxiety reducing and controlling techniques as meditation, touch and active relaxation, massage, yoga and VR ***Stillerman,*** (***2008)***

Regarding anxiety scores among study and control groups, the results of the current study indicated that, there was no statistically significant difference between study and control groups before intervention. There was a reduction on labor anxiety scores during the first stage of labor immediately after intervention, at cervical dilatation 4cm and at cervical dilatation 9cm) with a highly statistical significant difference between study and control groups (P<0.001). The results of this study came in harmony with ***Amiri, et al., (2019)***, who indicated that there was a significant difference in anxiety and stress during labor between intervention and control group. Increasingly, these results of the present study supported by ***Wong, et al., (2019),*** found that100% of subjects indicates that VR reduce their anxiety.

The results of the present study agreed with ***David, et al., (2019),*** the result indicate that there was a significant lower in anxiety scores in VR than non- VR group. Moreover, the results of the present study were similar to ***Sikka, et al., (2018)***, illustrated that there was a significant difference from pre and post intervention groups. Furthermore, the results of our study came in harmony with ***Sahin&Basak, (2020),*** illustrated that there was a statistically significant difference in anxiety between VR group and control group (p<.05).

According to Gate Control Theory of pain and previous experiences, parameters as anxiety, culture, stress and psychological factors have a powerful influence on the perception of pain by the brain. The intensity of pain signals, depending on the patient's concentration can be interpreted as very painful to mild pain when anxiety controlled ***(Shoorab, et al., 2015).***

These findings supported the present study hypothesis (2): that was" Women who apply virtual reality will have alleviated labor anxiety than those who don't".

Satisfaction is a personal evaluation of healthcare services and providers. These evaluations reflect the personal preferences of the individual, the individual's expectations,

and the realities of the care received. Satisfaction is the of the most frequently reported outcome measures for quality of care and enhanced satisfaction has been identified as a goal for improvement in health care. Women's satisfaction with maternity services, especially care during labor and birth, has become increasingly important to healthcare providers, and administrators. Women's satisfaction with childbirth is partly related to the health and well-being of the mother and her baby ***(Sawyer, et al., 2013).***

The results of present study clarified that the majority of women were satisfied with VR application (Total mean score percent = 82.3%). The results of the present the study were in accordance with ***Wong, et al., (2019),*** found that 100%of laboring women recommended VR intervention. Additionally, the results of the present the study come in the same line with ***Cowles, et al., (2019 a)***: The results showed that 77% of women reported that they would want to use VR again during a future labor.

In addition, these findings supported by ***David, et al., (2019),*** the results revealed that 82% reported completely and very much enjoying VR use during labor and 70% reported completely and very interested in new VR development specifically for childbirth. Also in a study by ***Sahin&Basak, (2020)***, the results showed that there was a significant difference between the VR and control group ($p<0.05$).

Furthermore, the results of our study come in harmony with ***Smith, et al., (2020),*** who researched "A randomized controlled trial to assess the feasibility of utilizing virtual reality to facilitate analgesia during external cephalic version", illustrated that 80% of the women receiving VR indicated that they would use VR again and 88% indicated that they recommend it to a friend having (ECV) External cephalic version. Moreover, the results of this study agreed with ***Sridhar, et al., (2020),*** the results illustrated that overall participants had a positive experience about VR intervention. The results of this study matched with ***Ebrahimian&Bilandi, (2020),*** indicated that there was significant difference in maternal childbirth satisfaction in the intervention than that of the control group. These results of satisfaction may be due to the interest for using non-pharmacologic therapies due to the non-invasive nature and no severe side effects.

These findings support present study hypothesis (3): that was "Women who apply virtual reality will have favorite labor (maternal and fetal) outcomes than those who don't".

Conclusion

Based on the results of the present study it could be concluded: Virtual reality was an effective method in reduction of labor pain scores and anxiety scores during the first stage of labor with a highly statistical significant difference between both control and study group after application of virtual reality. Moreover, there was a shorter duration of all stages of labor among study group women with a highly statistically significant difference between both study and control groups. In addition, there were obvious positive effects of VR intervention on maternal vital signs. Finally, the majority of women showed maternal satisfaction toward VR application.

Recommendations

In the light of the current study findings, the following recommendations can be suggested:

- Virtual Reality is recommended as an alternative non-pharmacological therapy, which can be applied in maternity hospitals for effective effect in labor pain and anxiety management.
- Develop antenatal mother's classes regarding the benefits of VR for both mothers and newborns.
- More studies are needed to replicate study on a larger sample for generalizing the findings to confirm the benefit of VR and analyze how to better applying.
- Future development for VR applications in laboring women either alone or as adjunct therapy- should focus on ease of use and intuitive design, prehospital education, custom-tailored virtual environments adaptability to variable patient positions (bed, chair, operating tables) to be more

advanced and more comfortable for longer periods of use.

- Future research should test different visualization and levels of user interaction. As playing games in addition to nature/meditation scenes. Women preferences should take into consideration by offering a variety of distraction techniques with a range of videos to choose from were they to choose virtual reality as a distraction technique.
- Future development of VR technologies for this application, coupled with larger-scale trials, would strengthen the evidence-base for alternative pain management interventions in ambulatory gynecology.

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