Effect Application of Immersive Virtual Reality as a Distraction Method on Anxiety and Satisfaction of Women Undergoing Cesarean Section

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Abstract:

Background: Virtual reality has proven to be effective in lessening anxiety and improving women's experiences in the medical and surgical field. **Aim of the Research** was to evaluate the effect application of immersive virtual reality as a distraction method on anxiety and satisfaction of women undergoing cesarean section. **Research Design:** A quasi-experimental research design (two groups, the study and control groups) was used. **Research Setting:** The research was conducted in Obstetrics and Gynecology Department at Benha University Hospital. **Subjects:** A purposive sample included 170 women undergoing cesarean sections and divided equally into the study and control groups. **Tools of data collection:** Three tools were used for data collection; Tool 1) structured interviewing questionnaire, Tool 2) novel visual facial anxiety scale and Tool 3) postoperative cesarean section satisfaction among delivered mothers questionnaire. **Results:** During application of virtual reality, 54.1% of the study group and 37.6% of the control group had mild visual facial anxiety. Also, after application of virtual reality, 41.2% of the study group and 21.2% of the control group had no visual facial anxiety. In addition, 72.9% of the study groups were satisfied with cesarean section after application of virtual reality and routine hospital care compared to 35.3% of the control group who only received routine hospital care. Besides, there were statistically significant relations between total visual facial anxiety scores with only the age and (gravidity & parity) of the study group before application of virtual reality $p \leq 0.05$. **Conclusion:** Virtual reality application was an effective method in reduction of anxiety of women undergoing cesarean section. Moreover, the study group was satisfied with all provided dimensions of routine hospital care more than the control group at 2 hours postoperative due to the distractive effect of the application of virtual reality during cesarean section. **Recommendation:** Encouraging hospitals administration for preparing virtual reality as supportive measure for women during cesarean section to lessen anxiety and enhance their satisfaction.

Keywords: Anxiety, Cesarean Section, Satisfaction, Virtual Reality

Introduction:

Cesarean section is the most common surgical procedure for women at reproductive age and is preferred over vaginal delivery due to the perception of being painless and safer. Cesarean sections are projected to rise to (28.5%) globally by (2030) **(Nahayo, et al., 2025)**. Egypt boasts an estimated cesarean section rate of (51.8%), ranking it as the third highest globally **(Alia, et al., 2025)**. According to WHO declarations, Egypt has led the world in that issue, accounting for (75%) to (80%) of all deliveries compared to a global average of (25%) to (30%) **(Aboushady, et al., 2024)**.

Cesarean section is often performed under regional anesthesia for conscious childbirth moment and immediate mother-newborn bonding; causing over (80%) of these women experience significant anxiety during cesarean section **(Xu, et al., 2024)**.

Perioperative maternal anxiety is associated with maternal psychological and physiological risks which include postpartum depression and hemodynamic parameters instability as hypertension and tachycardia. These risks can increase anesthesia complications and delay recovery **(Ibrahim, et al., 2025)**. As well as maternal anxiety has significant direct relationship with negative neonatal outcomes, as a low Apgar score and fetal distress **(Parandavar, et al., 2025)**.

There are many different pharmacological and non-pharmacological methods to reduce anxiety during cesarean section. pharmacological methods have different side effects such as over-sedation, respiratory depression and moreover fetal adverse reactions, while non-pharmacological methods usually have fewer or no side effects **(Jamshid, et al., 2022)**. Examples of non-pharmacological methods for anxiety management are psychological treatments, short films, mindfulness-based cognitive therapy, yoga, meditation, music therapy and nature-based sound therapy **(Parandavar, et al., 2025)**, as well as, immersive audio-visual distraction by virtual reality **(Ibrahim, et al., 2025)**.

Virtual reality is a novel, distractive, evidence-based and non-pharmacological method, which creates a computer-generated environment that fosters a strong sense of presence in virtual world through fully immersive (360°) virtual reality glasses; to maximize distraction, evoking emotional responses similar to the real world and enhancing the authenticity and immersive quality of the virtual environment **(Gerards, et al ., 2025)**.

The updating of virtual reality caused the possibility of its implementation in obstetrics field by helping the pregnant women undergoing cesarean section through generating relaxation that improves the operation outcomes **(Xu, et al., 2024)**.

Nurses play an important role in virtual reality application as nurses should integrate it into perioperative routine care and select suitable virtual reality materials for managing anxiety during cesarean section. Also nurses need a well-trained health care team to enhance virtual reality accessibility also affordability, provide technical support and benefit from telehealth to improve virtual reality usability widely **(Li, et al., 2025)**. Nurses are able to cover the physical and mental health for pregnant women at a global level and the potential of virtual reality technology applications extensively **(Mohammadi, et al., 2025)**.

Significance of the Research:

It was observed that there are rising trends in elective caesarean section in Egypt **(Aboushady, et al., 2024)**. The prevalence of preoperative anxiety during cesarean section is over (80%) compared to other surgical procedures due to doubts about the success of cesarean section, fear of the cesarean section threats, feelings of helplessness and low self-esteem which increased mortality during anesthesia **(Fentie, et al., 2022; Aker, et al., 2024)**.

Virtual reality is an effective and innovative technology that allows individuals to confront various mental health conditions as anxiety in safe and controlled manners by utilizing headsets to provide a sense of presence and realism to enhance relaxation techniques, mindfulness and promoting overall well-being **(Jingili, et al., 2023)**. In addition, there weren't previous studies that tackled this topic in Benha University hospitals.

Aim of the Research:

The research aim was to evaluate the effect application of immersive virtual reality as a

distraction method on anxiety and satisfaction of women undergoing cesarean section.

Research Hypotheses:

- **H1:** Women who would apply virtual reality during cesarean section would experience less anxiety than those who wouldn't apply it.
- **H2:** Women who would apply virtual reality would be satisfied with cesarean section more than who wouldn't apply it.

Operational definitions:

Immersive virtual reality is a new and distractive technology that is applied during the entire operation after regional anesthesia, to shift the woman's attention from anoxious operative stimuli to new virtual environments for keeping the woman more relaxed.

Research design:

A quasi-experimental research design (two groups, the study and control groups) was used to fulfill of the aim of the research.

Research setting:

The research was conducted in Obstetrics and Gynecology Department at Benha University Hospital (outpatient clinic, operating room and postnatal ward).

Subjects:

Sample type: A purposive sample was used.

Sample size: The total sample size was 170 pregnant participant women undergoing elective cesarean section for period of (9) months from the time of starting data collection.

Sample technique:

The total sample was divided equally into two groups (the study group who applied virtual reality and routine hospital care was (85) women) and the control group (who receive routine hospital care only was (85) women).

Inclusion criteria:

Women undergoing elective cesarean section with spinal or epidural anesthesia, of age 18-35 years old, free from any medical diseases and obstetrical complications, free from mental or psychological diseases, with normal vision and hearing abilities and willing and active participation in the study.

Tools of data collection:

Three tools were used for data collection:

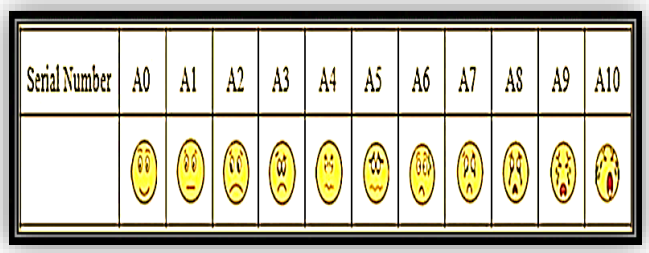
Tool I: A structured interviewing questionnaire: the researchers prepared it to collect basic data after reviewing related literatures **(Noben, et al., 2019; Almedhesh, et al., 2022; Hussein, et al., 2022; Elsharkawy, et al., 2022)** and then translated it into Arabic language. It included two parts such as:

Part (1): General characteristics of participant pregnant women: it included 3 items (age, marital status and level of education).

Part (2): Obstetrical history: it included 4 items (gravity, parity, gestational age and mode of previous delivery).

Tool II: A novel visual facial anxiety scale (NVFAS): It was developed by **(Cao, et al., 2017)** and adapted by the researchers to assess (acute state) of anxiety. This tool was composed of (11) different shapes of facial expressions in which the researchers assessed different degrees of anxiety from (0) no anxiety to (10) the highest anxiety level. Total anxiety score was classified as the following:

- **No anxiety** when score was→ **(0).**
- **Mild anxiety** when score was→ **(1-3).**
- **Moderate anxiety** when score was→**(4-7).**
- **Sever anxiety** when score was→ **(8-10).**



Tool III: Postoperative cesarean section satisfaction among delivered mothers questionnaire: This questionnaire was developed by **(Sarhan, et al., 2022; Abubakar, et al., 2023)** and adapted by the researchers to measure women's satisfaction with cesarean section after application of provided interventions for both groups. This tool had three dimensions (structural aspect of care "7 items", interpersonal dimension of care "11items" and outcome dimension of care "6 items"). Totally, it was composed of (24) statements rated on a 2-point Likert scale. Statements in structural aspect of care and interpersonal dimension of care were ranging from Unsatisfied (1) to Satisfied (2), and statements in outcome dimension of care were ranging from No (1) and Yes (2). The higher score indicated higher satisfaction and the total questionnaire score ranged from (24-48). Total satisfaction score was classified as the following:

- **Unsatisfied** when score was → (24-36).
- **Satisfied** when score was → (37-48).

Tools validity:

The tools of data collection was reviewed by a panel of three expert professors in Obstetrics and Gynecological Nursing to test content validity and modifications were done according to the panel's judgements on the clarity of sentences and the appropriateness of content.

Tools reliability:

The reliability was satisfactory by Cronbach's alpha coefficient test for tool II and tool III which revealed that; the internal consistency of tool II (NVFAS) was 0.71 and the internal consistency of tool III (Postoperative cesarean section satisfaction among delivered mothers questionnaire) was 0.98.

Ethical considerations:

Ethical aspects were considered before starting the research as the following: An approval was obtained from the Scientific Research Ethical Committee (REC-OBSN-DP99) at Faculty of Nursing at Benha University for fulfillment of the research. An official permission from the selected research settings was obtained for the fulfillment of the research.

Before applying the tools, the researchers explained the aim and importance of the research to gain participant pregnant women's trust. The researchers obtained a written informed consent from participant pregnant women to participate in the research and confidentialities were assured. The research didn't have any physical, social or psychological risks on the participant pregnant woman. All tools of data collection were burnt after statistical analysis to promote the confidentiality of the participant pregnant women. Also, research tools didn't include any immoral statements and respect human rights. The participant pregnant woman had the right to withdraw at any time freely.

Pilot study:

The pilot study was conducted on (10%) of the total duration that was 4 weeks, which were 12 women. It was conducted to test the simplicity, feasibility, clarity and applicability of the developed tool, also to find out the possible obstacles and problems that faced the researchers and interfered with data collection. According to the result of the pilot study, the tools III was required to be modified. So that,

the pilot study sample was excluded from the total study sample.

Field work:

The current research was carried out from the beginning of November, 2023 to the end of July, 2024 (covering nine months) for completing the research. The researchers visited the previously mentioned setting two consecutive days per week (Saturdays and Sundays) from 9 a.m. to 3 p.m. The researchers interviewed 3–5 women per week individually to collect data.

Preparatory phase:

The preparatory phase was the first phase of the field work of this research; the research was carried out through reviewing past and recent local and international related literature covering the various aspect of this research study using books, articles, magazines and network about the related studies to evaluate the effect of virtual reality on anxiety and satisfaction of women undergoing cesarean section. This helped the researchers to become acquainted with the magnitude and importance of the problem also, guided the researchers to prepare the required data collection tools.

The researchers prepared wearable Shinecon headset virtual reality glasses as well as a suitable mobile phone as Xiaomi Redmi 10 2022 smartphone, for applying the virtual reality videos. The researchers prepared playlists of immersive virtual reality environments videos that were accompanied by either Holy Quran surah recitations or calm relaxing music on the mobile phone to be applied during the entire duration of the cesarean section for about (60) minutes, as these videos created 360° audiovisual virtual environments during the operation. Examples of immersive virtual reality environments videos that were used during cesarean section were tours inside (Al-Masjid Al-Haram, The Prophet's Mosque, Al-Masjid Al-Aqṣā, the Italian countryside, forests, beaches, the island of Maldives and the sea world).

Virtual reality headset

Besides, the researchers prepared the printed-out representative photo cards of virtual reality environments videos to help participants make an informed and favorite choice for immersive experience in advance.

Then the researchers conducted the pilot study on (10%) of the total duration that was 4 weeks, which were 12 women. As a result of tools III that was required to be modified, the pilot study sample was excluded from the total sample**.**

Interviewing and assessment phase:

At the beginning of the interview, the researchers visited the research setting at Benha University Hospital two consecutive days per week (Saturdays and Sundays) and prepared a separated place at the waiting hall of the Obstetrics and Gynecology outpatient clinic away from over crowdedness for interviewing participant pregnant women to keep women's privacy, confidentiality and trust. The researchers introduced themselves and greeted with each pregnant woman undergoing elective cesarean section, then the researchers explained the aim of the research to pregnant woman, provided the pregnant woman with all information about the research and the researchers obtained the written informed consent from all women that were included in the research.

The researchers interviewed each participant pregnant woman using the following tools: Structured interviewing

questionnaire (Tool I), to assess general characteristics and obstetrical history of participant pregnant women in the waiting hall of Obstetrics and Gynecology outpatient clinic on (Saturdays), the day before the operation. The average time for the completion of this tool was around (5-10) minutes. Besides, the researchers assessed maternal visual facial anxiety (Tool II) at entering the operating room before application of virtual reality on (Sundays). The average time for the completion of this tool was around (2-3) minutes. This tool was collected at entering the operating room before application of virtual reality. This data gathered to serve as a baseline for subsequent comparisons to explore the virtual reality applicability for relieving anxiety during cesarean section.

Planning phase:

The researchers screened all pregnant women who underwent elective cesarean section on the day before the operation at Obstetrics and Gynecology outpatient clinic. Moreover, the pregnant woman file was examined to ensure that woman was eligible for the study and compatible to the inclusion criteria.

Then, the researchers divided the research sample into two equal groups (the study group was (85) women and the control group was (85) women). As the researchers began the study application with one participant pregnant woman for the study group, followed by one participant pregnant woman for the control group alternately.

The researchers provided a verbal explanation about how the virtual reality device and mobile phone were operating with immersive virtual reality environments. The researchers informed the pregnant participant woman about how the virtual reality glasses were applied during cesarean section. As well as the duration of wearing of virtual reality glasses.

The researchers told the pregnant participant woman about the variety of offered selections of relaxing audio-visual virtual reality environments videos to choose from.

The researchers clarified to the pregnant participant woman the time points for measuring data collection tools before, during and after application of virtual reality to evaluate the effect of immersive virtual reality as a distraction method on anxiety and maternal satisfaction of women undergoing cesarean section.

Implementation phase:

For the study group (virtual reality group):

The routine hospital care was given to the study group by the hospital staff in addition to application of virtual reality.

Before entering the operating room, the researchers informed the participant pregnant woman about the different and available kinds of virtual reality videos and ask the woman to choose the videos to be watched from the preprepared cards.

The researchers prepared a playlist of these selected videos with approximate duration of (60) minutes on mobile phone in standby mode for starting to avoid the video display termination before finishing cesarean section for better audio-visual distraction.

Also, the researchers kept the mobile phone in aeroplane mode to avoid receiving phone calls or any mobile notifications while watching videos.

While the participant pregnant woman was prepared for regional anesthesia, the researchers sterilized virtual reality glasses and mobile phone with alcohol (70%) to avoid transmission of contamination or nosocomial infection between participant pregnant women.

The researchers opened the virtual reality glasses' cover and put the mobile phone inside virtual reality glasses. Then, the researchers closed the cover well to avoid the mobile phone falling and connected the headphone socket with the mobile phone.

After that, the researchers put the virtual reality glasses on the participant pregnant woman's head and adjusted them to fit participant pregnant woman's head circumference and eye orbit. Additionally, the researchers adjusted the depth of vision field to focus on videos for clear and better vision. Also, the researchers ensured that virtual reality headset was adjusted to her ear to for better video sounds hearing and external environmental sounds isolation.

Then, the researchers pressed the video play button on the virtual reality glasses and enhanced the participant pregnant woman to be more relaxed, feeling as living in, visiting and exploring new environments.

The desirable list started playing after regional anesthesia and continued during the entire operation until the skin suturing was completed (the time of removing the virtual reality glasses).

The participant woman was assessed by **Tool II** (novel visual facial anxiety scale (NVFAS) was assessed at two points as following: At the end of skin suture "during application of virtual reality" and at 2 hours postoperative "after application of virtual reality".

Moreover, the researchers assessed the women satisfaction regarding (structural aspect of care, interpersonal dimension of care and outcome dimension of care) at 2 hours postoperative "after application of virtual reality" by **Tool III** (Postoperative cesarean section satisfaction among delivered mothers questionnaire). The average time needed to complete this tool was (5-10) minutes.

For the control group:

The participant pregnant women received the routine hospital care by health care provider. The researchers visited the previously mentioned research setting two days per week from 9 a.m. to 3 p.m., the researchers interviewed the participant pregnant women and collected tools (II and III): The same time measurements for (novel visual facial anxiety scale (NVFAS) and postoperative cesarean section satisfaction among delivered mothers questionnaire) were followed without applying virtual reality glasses as a method of relieving anxiety.

Evaluation phase:

After application of virtual reality technology on the study group, the researchers evaluated the effect of virtual reality on anxiety and woman's satisfaction regarding (structural aspect of care, interpersonal dimension of care and outcome dimension of care) by using tools (II and III) at 2 hours postoperative "after application of virtual reality as well as the control group.

Statistical analysis:

The researchers verified data prior to computerized entry and used the statistical package for social sciences (SPSS version 25) for that purpose, followed by data tabulation and analysis. Descriptive statistics were calculated for the data (e.g., mean and standard deviation for quantitative data) and (frequency and distribution for qualitative data). As well as, the significance of difference was tested using one of the following tests: (Chi square test and fisher exact test for intergroup comparison of categorical data) and (independent t-test was used to compare mean of two groups of quantitative data).

- When p-value was < 0.05, it was considered statistically significant (*).
- While p-value was > 0.05, it was considered statistically insignificant and p-value was < 0.01, it was considered highly

significant (**) in all analyses.

Results:

Table (1) clarifies that 60.0% of study group and 59.9% of the control group in age group from 24 - ≤ 29 years old with mean age 27.73±4.25 years old of the study group and 26.86±4.62 years old of the control group respectively. Also, 100% of the control group meanwhile, 97.6% of the study group were married. Concerning level of education, it was cleared that 47.1% of the study group and 49.4% of the control group respectively had secondary education. Generally, there was no statistically significant difference between study and control groups regarding general characteristics. That is reflected groups homogeneity.

Table (2) displays that 58.8% of the study group and 68.2% of the control group respectively were multigravida. Increasingly, 57.6% of the study group and 65.9% of the control group respectively were multipara. Moreover, 41.2% of the study group and 43.5% of the control group respectively had gestational age from 39-40 weeks with a mean gestational age of 39.07±1.51 weeks of the study group and 39.25±1.44 weeks of the control group respectively. In relation to mode of last delivery, 66.1% of the study group and 64.3% of the control group respectively performed caesarean section for the last delivery. Generally, there was no statistically significant difference between the study and control groups regarding obstetrical history p > 0.05. That is the two groups under study homogenous.

Figure (1) shows that, "at entering the operating room and before anesthesia "before application of virtual reality"" 61.2% of the study group and 58.8% of the control group respectively had moderate visual facial anxiety. Meanwhile, "at the end of skin suture "during application of virtual reality""; 54.1% of the study group had mild visual facial anxiety as compared with 37.6% of the control group. Also, at 2 hours postoperative "after application of virtual reality, 41.2% of the study group and 21.2% of the control group respectively had no visual facial anxiety.

Figure (2) illustrates that, 72.9% of women in the study group were satisfied with cesarean section after application of virtual reality and routine hospital care compared to 35.3% of women in the control group who only received routine hospital care.

Table (3) denotes that, there was a statistically significant relation between total visual facial anxiety score and only the age of the women in the study group "at entering the operating room and before anesthesia before application of virtual reality p ≤ 0.05. While, there was no statistically significant relation between total visual facial anxiety score and general characteristics of participant pregnant women in study group "at the end of skin suture "during application of virtual reality"" P > 0.05.

Table (4) demonstrated that, there was a statistically significant relation between total visual facial anxiety score and (gravidity and parity) of the women in the study group "at entering the operating room and before anesthesia before application of virtual reality. While, there was no statistically significant relation between total visual facial anxiety score and selected items of obstetrical history of the women in the study group "at the end of skin suture during application of virtual reality.

Table (1): Distribution of studied sample according to general characteristics for both groups (the study and control groups) (n=170).

General characteristics	Control group n=85		Study group n=85		Chi square test/FET	P-value
	No.	%	No.	%		
Age (in years)					1.720	4.220
18 - ≤ 23.	22	25.9	15	17.6		
24 - ≤ 29.	45	59.9	51	60.0		
30 - ≤ 35.	18	21.2	19	22.4		
Mean ±SD	**26.86±4.62**		**27.73±4.25**			
Marital status					2.020	0.364
Married.	85	100.0	83	97.6		
Divorce.	0	0.0	1	1.2		
Widowed.	0	0.0	1	1.2		
Level of education					0.640	0.887
Illiterate.	5	5.2	6	7.1		
Primary education.	9	10.6	12	14.1		
Secondary	42	49.4	40	47.1		
education.	29	34.1	27	31.8		
High education.						

No statistical significant p > 0.05.

Table (2): Distribution of studied sample according to obstetrical history for both groups (the study and control groups) (n=170).

Obstetrical history	Control group n=85		Study group n=85		Chi square test	P-value
	No.	%	No.	%		
Gravidity					1.620	0.202
Primigravida.	27	31.8	35	41.2		
Multigravida.	58	68.2	50	58.8		
Parity					1.220	0.269
Primipara.	29	34.1	36	42.4		
Multipara.	56	65.9	49	57.6		
Current gestational age (in weeks):					0.781	0.677
37-38.	20	23.5	25	29.4		
39-40.	37	43.5	35	41.2		
> 40.	28	32.9	25	29.4		
Mean ±SD	**39.25±1.44**		**39.07±1.51**		**Independent t-test =1.680**	**0.095**
Mode of previous delivery n=56			**n=49**		1.550	0.213
Vaginal delivery.	20	35.7	12	24.5		
Caesarean section.	36	64.3	37	66.1		

No statistical significant p > 0.05.

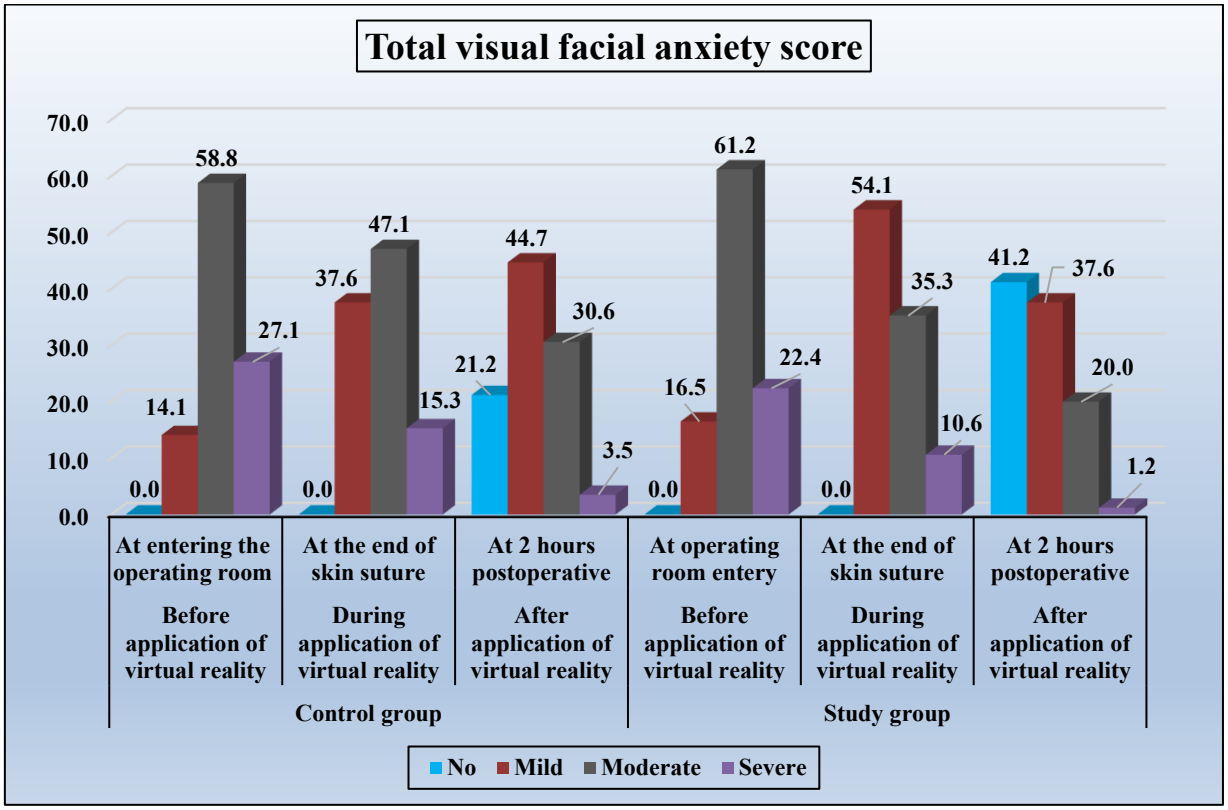


Figure (1): Distribution of the studied samples' total visual facial anxiety score in both groups (the study and control groups) before, during and after application of virtual reality (n=170).

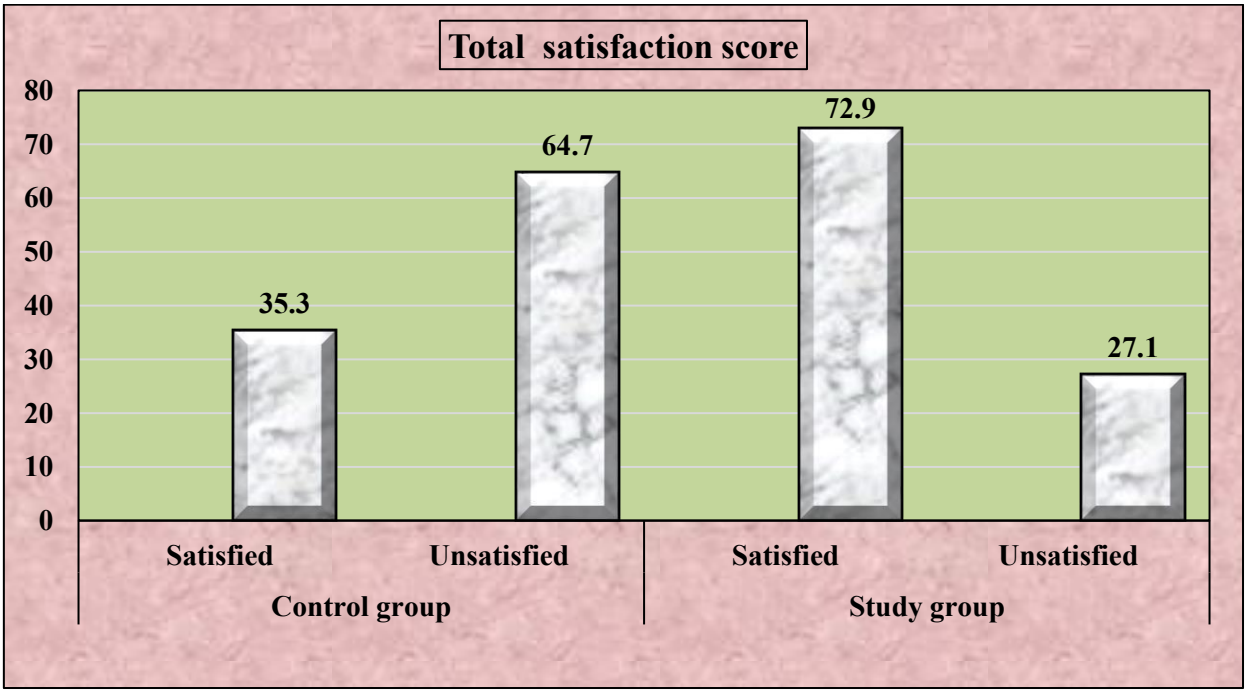


Figure (2): Distribution of the studied samples' total satisfaction score in both groups (the study and control groups) after application of virtual reality (n=170).

Table (3): Relation between general characteristics of women in study group and their total visual facial anxiety score before and during application of virtual reality phases (n=85).

General characteristics	Total visual facial anxiety score															
	Before application of virtual reality "at entering the operating room"								During application of virtual reality "at the end of skin suture"							
	Mild n=14		Moderate n=52		Severe n=19		X^2	P-value	Mild n=46		Moderate n=30		Severe n=9		X^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Age (in years)																
18 - <23	2	14.3	5	9.7	8	42.1	**12.13**	**0.016***	8	17.4	6	20.0	1	11.1	**0.518**	**0.972**
23 - <29	9	64.3	32	61.5	10	52.6			27	58.7	18	60.0	6	66.7		
29 - ≥ 35	3	21.4	15	28.8	1	5.3			11	23.9	6	20.0	2	22.2		
Marital status																
Married	13	92.9	51	98.1	19	100.0	**5.75**	**0.219**	45	97.8	29	96.7	9	100.0	**2.68**	**0.611**
Divorced	0	0.0	1	1.9	0	0.0			1	2.2	0	0.0	0	0.0		
Widowed	1	7.1	0	0.0	0	0.0			0	0.0	1	3.3	0	0.0		
Level of education																
Not read and write	1	7.2	4	7.7	1	5.2	**1.56**	**0.955**	3	6.5	2	6.6	1	11.1	**2.96**	**0.813**
Primary education	3	21.4	6	11.5	3	15.8			7	15.2	5	16.7	0	0.0		
Secondary education	7	50.0	24	46.2	9	47.4			20	43.5	14	46.7	6	66.7		
High education	3	21.4	18	34.6	6	31.6			16	34.8	9	30.0	2	22.2		

No statistical significant p > 0.05. * A statistical significant p ≤ 0.05.

Table (4): Relation between selected items of obstetrical history of women in study group and their total visual facial anxiety score before and during application of virtual reality phases n=85.

Selected items of obstetrical history	Total visual facial anxiety score															
	Before application of virtual reality "at entering the operating room"								During application of virtual reality "at the end of skin suture"							
	Mild n=14		Moderate n=52		Severe n=19		X^2	P-value	Mild n=46		Moderate n=30		Severe n=9		X^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Gravidity																
Primigravida	2	14.3	20	38.5	13	68.4	**10.16**	**0.006***	20	43.5	12	40.0	3	33.3	**0.346**	**0.841**
Multigravida	12	85.7	32	61.5	6	31.6			26	56.5	18	60.0	6	66.7		
Parity																
Primipara	2	14.3	21	40.4	13	68.4	**9.88**	**0.007***	21	45.7	12	40.0	3	33.3	**0.573**	**0.751**
Multipara	12	85.7	31	59.6	6	31.6			25	54.3	18	60.0	6	66.7		
Compliance with antenatal care follow up																
Yes	6	42.9	27	51.9	15	78.9	**5.39**	**0.067**	25	54.3	17	56.7	6	66.7	**0.465**	**0.792**
No	8	57.1	25	48.1	4	21.1			21	45.7	13	43.3	3	33.3		

No statistical significant p > 0.05. * A statistical significant p ≤ 0.05.

Discussion:

Virtual reality is a novel, distractive and non-pharmacological technology serves as an alternative psychological technique and approved in lessening operative anxiety due to being immersive, promising, less side effects, interactive, cheap and user-friendly **(Ahmed, et al., 2025)**. So that, the present research aim was to evaluate the effect of immersive virtual reality as a distraction method on anxiety and satisfaction of women undergoing cesarean section.

According to general characteristics of participant pregnant women, the current research study demonstrated that less than two-thirds of the study group and more than half of the control group in age group from 24 - ≤ 29 years old) with mean age 27.73±4.25 years old of the study group and 26.86±4.62 years old of the control group respectively. Also, the majority of the control group and study group were married. Concerning level of education, it was cleared that less than half of the study and control groups respectively had secondary education. Generally, there was no statistically significant difference between the study and control groups regarding general characteristics. That is reflected groups homogeneity.

According to the researchers' opinion, this homogeneity was due to the purposive selection of sample that was chosen based on specific inclusion criteria. Homogeneity was useful for generalization of the current study results and avoiding the effect of confounding variables.

These results of the present study agreed with **Ibrahim, et al., (2025)** who studied "Effect of virtual reality on anxiety, satisfaction level and hemodynamic parameters among women during cesarean section" demonstrated that mean age of the study group was (27.7±4.7) years old and the control group was (27.2±4.6) years old, also there were homogeneity between two groups. Increasingly, the findings of the present study were congruent with **Hussein, et al., (2022)** who examined "Usability of virtual reality for alleviating pain and anxiety for primiparity and anxiety for primiparity women during the 1st stage of labor and its reflection on labor outcomes" clarified that (45.5%) of the study group and (50.0%) of the control group respectively had secondary education. Also, the two groups under study homogenous.

As regard obstetrical history, the current research study demonstrated that more than half of the study group and more than two-thirds of control group respectively were multigravida. Increasingly, more than half of the study group and less than two-thirds of control group respectively were multipara. Moreover, more than two-fifths for both the study and control groups respectively had gestational age from 39-40 weeks with a mean gestational age of 39.07±1.51 weeks of the study group and 39.25±1.44 weeks of control group respectively. In relation to mode of last delivery, less than two-thirds of the study group and control group respectively performed caesarean section for the last delivery. Generally, there was no statistically significant difference between the study and control groups regarding obstetric history. That is the two groups under study homogenous.

According to the researchers' point of view, this homogeneity was due to inclusion and exclusion criteria that the researchers were adhering to.

The findings of the current study were similar to **Elsharkawy, et al., (2022)** who researched "Efficacy of virtual reality application as a distraction for primiparity women at 1st stage of labor on pain and anxiety control" showed that mean gestational age were (39.56±1.35) weeks of virtual reality

group and (39.40±1.44) weeks of the control group respectively. Also, there was homogeneity between two groups.

Moreover, these findings were consistent with **Noben, et al., (2019)** who tested "A virtual reality video to improve information provision and reduce anxiety before cesarean delivery: randomized controlled trial" revealed that (35%) of virtual reality group and (33%) of the control group delivered by cesarean section previously. Also, there was homogeneity between two groups.

Vice versa, the results of the present study incongruent with **(Xu, et al., 2024)** who studied "Virtual reality treatment could reduce anxiety for women undergoing cesarean section with spinal anesthesia: a randomized controlled trial" reported that mean gravidity was (1±0.1) of both groups respectively. According to researchers' opinion, the differences in results might be due to increase the researchers desire to apply the intervention to primigravida because of high level of anxiety between participants.

Pertaining maternal anxiety, the current research study revealed that, "at entering the operating room and before anesthesia "before application of virtual reality ""; less than two-thirds of the study group and more than half of the control group respectively had moderate visual facial anxiety. Meanwhile, "at the end of skin suture "during application of virtual reality""; more than half of the study group had mild visual facial anxiety as compared with more than third of the control group. Also, "2 hours postoperative "after application of virtual reality "", more than two-fifths of the study group and more than fifth of the control group respectively had no visual facial anxiety.

The results of the present study were supported by reticular activation theory that proposed that audio and visual distraction could overcome anxiety through receiving sufficient and excessive sensory input, thereby causing anxiety impulses to be blocked to the brain so that anxiety is reduced or not felt. As well as, pleasant sensory stimulus inputs would stimulate pituitary gland to secrete endorphins which is (feel good chemicals) **(Purnomo, et al., 2024)**.

The findings of current study were congruent with **Ibrahim, et al., (2025)** who demonstrated that virtual reality significantly reduced anxiety in women undergoing cesarean delivery under regional anesthesia. Moreover, the result of the current study were supported by **Almedhesh, et al., (2022)** who examined "The effect of virtual reality on anxiety, stress and hemodynamic parameters during cesarean section: a randomized controlled clinical trial" commented that virtual reality significantly reduced anxiety among women undergoing cesarean section. As well as, the results of the present study were similar to **Hussein, (2022)** who revealed that virtual reality had a positive effect on anxiety.

These results of current study supported the present research hypothesis (1) that was: Women who would apply virtual reality during cesarean section would experience less anxiety than those who wouldn't apply it.

In contrast, the results of the present study were inconsistent with **Noben, et al., (2019)** who reported that virtual reality didn't lead to a decrease in preoperative anxiety. These variations might be due to lower level of the study group education, but in current studied women were relatively highly educated.

Regarding maternal satisfaction with cesarean section, the current research study illustrated that, less than three-quarters of women in study group were satisfied with cesarean section after application of virtual reality and routine hospital care compared to

more than third of women in control group who only received routine hospital care.

According to the researchers' opinion, this might be due to the marked and positive effect of virtual reality, as well as, the women's desire to try a novel, non-pharmacologic, non-invasive, nature and less side effects technology. So that, virtual reality can be added to routine perioperative care due to it's emotional healing and calming effects.

The results of the current study were in the same line with **Özer, et al., (2024)** who tested "Effects of virtual reality interventions on the parameters of normal labor: a systematic review and meta-analysis of randomized controlled trials" commented that virtual reality applications are effective methods and increase satisfaction with provided care. Furthermore, the results of our study were 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 who were using virtual reality were satisfied and indicated that they would use virtual reality again.

Concerning correlation between total visual facial anxiety and sociodemographic characteristics, the present research study clarifies that there was a statistically significant relation between total visual facial anxiety scores and only the age of the women in the study group at "at entering the operating room and before anesthesia "before application of virtual reality"" $p \leq 0.05$. While, there was no statistically significant relation between total visual facial anxiety scores and general characteristics of the women in study group "at the end of skin suture "during application of virtual reality"" $P > 0.05$. This might be due to young age pregnant women haven't yet reached emotional and cognitive maturity status. These women are unable to make future decisions and fear of making a wrong decision leading to high-risk from different mental disease as anxiety and psychological agitation.

The results of the present study were harmony with **González-Sanguino, et al., (2020)** who studied "Stress, anxiety and depression levels in the initial stage of the COVID-19 outbreak in a population sample in the northern Spain" told that there was a possible negative relationship between anxiety and age. Additionally, the results of the present study were consistence with **Huang and Zhao, (2020)** who tested "Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey" demonstrated that the prevalence of anxiety was significantly higher in participants younger than 35 years than in participants aged 35 years or older.

Oppositely, the results of the present study were in congruent with **Lei, et al., (2025)** who researched "Relationship between anxiety symptoms and age-related differences in tic severity" revealed that there was positive correlation between severity of anxiety which increased linearly with age. According to researchers' point of view, these variations in our results and this result might be due to the study sample was from adolescents who are often fear of social reactions, stigma, bullying from society, social isolation and failure to adequately control anxiety symptoms. These lead to exacerbate anxiety and lead to more severe symptoms.

Pertaining, correlation between total visual facial anxiety and obstetrics history, the results of present research study demonstrated that, there was a statistically significant relation between total visual facial anxiety scores and (gravidity and parity) of the women in the study group "at entering the operating room

and before anesthesia "before application of virtual reality p ≤0.05. While, there was no statistically significant relation between total visual facial anxiety scores and selected items of obstetrics history of the women in the study group "at the end of skin suture during application of virtual reality. This might be due to fewer experiences of both primigravida and primipara with cesarean section's indications, care knowledge, complications during operation or anesthesia and no familiarity with the settings of cesarean section.

The results of the current study were harmony with **Kazemi, et al., (2023)** who researched "Anxiety disorders in pregnant women and its effects on choosing the delivery method" showed that the women, who preferred cesarean section were associated with higher levels of anxiety and first pregnancy (primigravida). Vice versa, the results of the present study were in congruent with **Asali, et al., (2023)** who examined "Correlates of higher anxiety scores reported by women admitted for elective caesarean section" reported that history of a previous cesarean section (multipara) was associated with higher anxiety scores without statistical significance. These variations might be due to the presence of maternal and fetal indications of cesarean sections that leads to high levels of maternal anxiety.

Conclusion:

Based on the results of the current study, it could be concluded that virtual reality application was an effective method in reduction of anxiety of women undergoing cesarean section with a statistically significant difference in the level of anxiety between both the study and control groups. Besides, the participants of the study group were satisfied with the application of virtual reality during cesarean section. Also, participants of study group were more satisfied with all provided dimensions of routine hospital care than the control group at 2 hours postoperative due to distractive effect of virtual reality and continuous communication between the researchers and participants of study group. So that the research aim was achieved and the research hypotheses were proved.

Recommendations:

- Encouraging hospitals administration for preparing virtual reality as supportive measure for women during cesarean section to lessen anxiety and enhance their satisfaction.
- Considering virtual reality as a part of routine hospital care in Obstetrics and Gynecology Departments.

Further studies need to be performed:

- Confirming the anxiolytic and sedative effects of virtual reality on both elective and selective cesarean sections.

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تأثير تطبيق الواقع الإفتراضي الغامركوسيلة إلهاء على قلق و رضا السيدات اللاتي يخضعن للولادة القيصرية

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لقد أثبت الواقع الإفتراضي فعاليته في تقليل القلق وتحسين تجارب النساء في المجال الطبي والجراحي. **الهدف من الدراسة:** تقييم تأثير تطبيق الواقع الإفتراضي الغامر كوسيلة إلهاء على قلق ورضا السيدات اللاتي يخضعن للولادة القيصرية. **تصميم الدراسة:** تم إستخدام تصميم شبه تجريبي (مجموعتان، مجموعة الدراسة والمجموعة الضابطة. **مكان الدراسة:** وأجريت الدراسة في قسم أمراض النساء و التوليد بمستشفى بنها الجامعي. **عينة الدراسة**: عينة غرضية مكونة من (١٧٠) سيدة حامل خضعت للولادة القيصرية وقسمن بالتساوي إلى مجموعتي الدراسة والضابطة. **أدوات جمع البيانات**: تم إستخدام ثلاث أدوات لجمع البيانات: ١) إستمارة الإستبيان و المقابلة الشخصية٢) مقياس القلق الوجهي البصري الحديث ٣) إستبيان رضا الأمهات بعد الولادة القيصرية. **النتائج:** كشفت النتائج أنه أثناء تطبيق الواقع الإفتراضي، كان لدى ٥٤,١٪ من مجموعة الدراسة و ٣٧,٦٪ من المجموعة الضابطة قلق بصري وجهي خفيف. ، بعد تطبيق الواقع الإفتراضي، لم يكن لدى ٤١,٢٪ من مجموعة الدراسة و ٢١,٢٪ من المجموعة الضابطة أي قلق بصري وجهي. بالإضافة إلى ذلك، كان ٧٢,٩٪ من مجموعة الدراسة راضيات عن الولادة القيصرية بعد تطبيق الواقع الإفتراضي والرعاية الروتينية في المستشفى مقارنة بـ ٣٥,٣٪ من المجموعة الضابطة الذين تلقوا الرعاية الروتينية فقط في المستشفى. إلى جانب ذلك، كانت هناك علاقات ذات دلالة إحصائية بين إجمالي درجات القلق الوجهي البصري مع العمر و (عدد مرات الحمل و الولادة) فقط لمجموعة الدراسة قبل تطبيق الواقع الإفتراضي. **الاستنتاج**: وتم إستنتاج أن تطبيق الواقع الإفتراضي الغامر كوسيلة إلهاء له تأثير إيجابي على تقليل قلق السيدات الخاضعات للولادة القيصرية، علاوة على ذلك، كانت مجموعة الدراسة راضيات عن جميع أبعاد الرعاية الروتينية في المستشفى أكثر من المجموعة الضابطة بعد ساعتين من الولادة بسبب التأثير التشتيتي لتطبيق الواقع الإفتراضي أثناء الولادة القيصرية. **التوصيات**: تشجيع إدارة المستشفيات على إعداد الواقع الإفتراضي كإجراء داعم للسيدات أثناء الولادة القيصرية لتقليل القلق وتعزيز رضاهن.