J Caring Sci, 2024, 13(4), 244-255
doi: 10.34172/jcs.33458
https://jcs.tbzmed.ac.ir

Original Article

The Effectiveness of Virtual Reality Application for Women Undergoing Episiotomy Repair: A Systematic Review and Meta-analysis

Elham Manouchehri[1], Somayeh Makvandi[2], Zahra Hadizadeh Talasaz[3,4], Elham Azmoude[5], Mona Larki[3,4*]

[1]Department of Midwifery, Faculty of Nursing and Midwifery, Mashhad Medical Sciences, Islamic Azad University, Mashhad, Iran
[2]Department of Midwifery, Menopause Andropause Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[3]Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[4]Department of Midwifery, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran
[5]Department of Midwifery, School of Nursing and Midwifery, Neyshabur University of Medical Sciences, Neyshabur, Iran

Article Info

Article History:
Received: April 5, 2024
Accepted: July 27, 2024
ePublished: November 4, 2024

Keywords:
Virtual reality, Virtual glasses, Episiotomy, Pain, Anxiety, Satisfaction

***Corresponding Author:**
Mona Larki,
Email: mona.larki66@gmail.com

Abstract

Introduction: Virtual reality (VR) is effective in several healthcare domains. As of date, there have been no systematic reviews investigating the efficacy of VR technology in episiotomy repair in women. This systematic review and meta-analysis examined the effects of using VR on pain, anxiety and satisfaction in women under episiotomy repair.

Methods: For the original articles, six databases were searched using relevant keywords without restriction on time or languages until June 6, 2024. The Cochrane risk-of-bias tool for randomized trials (RoB) and the Risk of Bias Assessment Tool for Nonrandomized Studies (RoBANS) were both used to assess the risk of bias in randomized and non-randomized studies, and the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) also determined the quality of our evidence. All analyses employed Comprehensive Meta-Analysis (CMA) V.2.

Results: Five randomized clinical trial and two quasi-experimental studies with poor-to high-quality met the inclusion criteria. The VR significantly decreased perineal pain during [MD (95% CI)=-1.622 (-2.598, -0.645), $P=0.001$], immediately after [MD (95% CI)=-1.931 (-2.785, -1.076), $P<0.001$], and one hour after [MD (95% CI)=-1.596 (-2.436, -0.765), $P<0.001$]. It also significantly decreased anxiety [SMD (95% CI)=-1.48 (-2.451, -0.509), $P=0.003$] after repair. VR group participants were significantly more satisfied than the control group. The quality of was moderate for perineal pain intensity one hour after episiotomy repair and anxiety after episiotomy repair.

Conclusion: Given the efficacy of VR on pain, anxiety, and satisfaction, it is suggested that it be utilized as a novel modality to enhance the quality of maternity hospital care.

Introduction

Episiotomy is a vital and life-saving procedure when indicated.[1] Its global prevalence is varied, ranging from 45.11% in Ethiopia,[2] China 41.7%,[3] Iran 86.3%,[4] and 47% in public hospitals to 68% in private hospitals in Brazil.[5] Episiotomy procedures can cause incision infections, scar dyspareunia, and acute postpartum pain in mothers.[6,7] This common surgery could cause anxiety in women; therefore, sleep-inducing drugs, tranquilizers, and nerve blockers such as lidocaine may be prescribed.[8] Providing relief and satisfaction, which are fundamental needs at birth, is highly challenging, especially since there are not sufficient investigations on the topic.[1] Non-pharmacological methods, such as virtual reality (VR) applications utilized throughout episiotomy healing, are gaining popularity nowadays due to their determinism, nature, and lack of adverse effects.[8] VR technology can create a simulated environment and divert patients' attention away from pain sensations.[9] Additionally, it is cost-effective, secure, non-invasive, free from the risks of drug addiction, and useful as an analgesic.[10,11] VR technology offers immersive three-dimensional (3D) images using a head-mounted headset and controllers. This allows users to fully engage and interact with the virtual environment.[12] Essentially, VR functions by diverting attention away from potentially unpleasant present experiences towards more enjoyable stimuli, thereby altering the perceived environment.[13]

Most typically, VR is utilized to assist pregnant women

in having a more comfortable pregnancy, decreasing their level of anxiety, and teaching them how to effectively deal with their labor pain.[14-16] VR has developed into a novel tool in recent decades that is applied to lessen discomfort and anxiety during painful procedures.[17] Due to their ability to reduce pain without surgery or medication, VR technology and alternative techniques are currently attracting increased interest from women.[18] Therefore, it becomes essential for midwives and other maternity care professionals to be familiar with these alternative techniques, such as VR applications, to lessen the discomfort and anxiety that might arise during episiotomy repair.[8]

The findings of Orhan and Bülez revealed that there was no significant difference in the mean scores for pain assessed before and after episiotomy repair between the intervention (5 mL of lidocaine plus VR glasses) and control groups (5 mL of lidocaine).[1] According to the findings of another investigation conducted by Ahmed Osman Mohamed et al women who had episiotomies expressed satisfaction with the VR implementation, and there was a highly significant difference in their levels of anxiety.[19] In one study, anxiety decreased following episiotomy repair, but not significantly.[20]

The creation of a safe childbirth environment is vital for women to have a pleasant birth experience, and VR has a lot of advantages as a safe alternative. However, for VR to be applied to obstetric care, there needs to be strong evidence to investigate the effectiveness and acceptability of the repair of perineal injuries after childbirth. Additionally, over the course of the past few years, there has been an increase in the number of studies that have focused on how VR could relieve pain and anxiety. However, the majority of these studies are of a small size and apply to a wide variety of clinical procedures with contradictory outcomes. As a result, this demonstrates the need for a thorough review and meta-analysis of VR interventions in women undergoing episiotomy repair.

The purpose of this study was to investigate and determine the application of VR as a new modality for pain, anxiety, and satisfaction in women undergoing episiotomy repair.

Materials and Methods

This systematic review and meta-analysis follows the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) standards.[21]

Search Strategy

For original publications about "the effect of VR application on women's outcomes undergoing episiotomy repair," a search was conducted until June 6, 2024. The search process was conducted for MEDLINE through the PubMed interface, Scopus, Web-of-Science, Science Direct, the Cochrane Central Register of Controlled Trials (CENTRAL), and Google Scholar. The search terms included MESH, entrance terms, and keyword selections by experts. They comprised: virtual reality, virtual reality therapy, virtual reality exposure therapy, perineum, perineal injury, perineal trauma, episiotomy, birth satisfaction, patient satisfaction, pain intensity, pain management, fear, stress, and anxiety. In order to enhance accuracy throughout the search procedure, we employed Boolean terms (AND/OR) to differentiate between the keywords (Supplementary file 1).

Inclusion and Exclusion Criteria

Articles were included that met the following criteria: (*a*) Type of study: randomized clinical trials (RCTs) and quasi-experimental studies in which the effect of VR application on pain and/or anxiety and/or satisfaction and/or fear among women under episiotomy repair has been investigated. (*b*) Type of intervention: application of VR for any length of time during episiotomy repair was considered; (*c*) Outcomes: pain of episiotomy, anxiety, and maternal satisfaction of episiotomy were considered. We imposed no language and no time restrictions.

Data Abstraction

After the removal of duplicate papers and unrelated items, two separate authors reviewed the primary output of the search process in terms of the abstract and title. Subsequently, we examined the full text of the remaining publications. After removing irrelevant articles, only articles that met the qualifying requirements remained. In cases where there was a dispute between reviewers, the two assessors would discuss their differences in order to get a final conclusion; if disagreement persisted, a third participant would get involved in the conversation.

Data Extraction

To extract the data, the research team created a tool based on the objects. The first author's name, the publication year, the country, the type of study, the sample size, sample characteristics, the intervention, the comparison, and the tools used to collect the data, the quality assessment, and the outcomes were all listed. If data extraction needed more information, the author was contacted.

Risk of Bias and Certainty of Evidence

Two authors independently assessed the quality of the included studies. The risk of bias for randomized and non-randomized trials was evaluated using the Cochrane risk-of-bias tool for randomized trials (RoB) [22] and the Risk of Bias Assessment Tool for Nonrandomized Studies (RoBANS) tool, respectively.[23]

The ROB tool was implemented to examine each -RCT in 7 domains: (sequencing, concealed allocation, selective reporting, participant and staff blinding, outcome assessment blinding, incomplete results, and other biases). The RoBANS tool includes six domains that assess bias in participant selection: confounding variables, exposure

measurement, outcome assessment blinding, incomplete outcome data, and selective outcome reporting. In both instruments, each domain was rated as "yes," "no," or "unclear." Then, each study was classified into 1 of 3 categories: "poor" (high risk of bias), "good" (low risk of bias), or "unclear." Any disagreement between the researchers was resolved through discussion.

Furthermore, we assessed the certainty of evidence using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE).[24] The outcomes of pain and anxiety were evaluated for upgrading or downgrading based on the risk of bias, imprecision, inconsistency, and indirectness. Each of these outcomes received a certainty of evidence grading ranging from "very low" to "high."

Ethical Considerations

This systematic review and meta-analysis are approved by Mashhad University of Medical Sciences, Mashhad, Iran (code number: 4020925, IR.MUMS.NURSE.REC.1402.086). In this investigation, we followed all research ethics guidelines. The writers made an effort to avoid any misconduct, fabrication, or falsification during the identification, screening, extraction, and data analysis steps, as well as double publication and/or submission.

Statistical Analyses

In our quantitative analysis, the difference in means (MD) of quantitative data was computed as the main effect size. When measurements of outcome were taken for continuous outcomes across all trials using the same scale, the MD with 95% CI was computed (Pain). When the same outcome was assessed in various ways in articles included in the meta-analysis, standardized mean difference (SMD) was applied (anxiety). A random effects model was also used for pooling the results of the studies. Forest plots were utilized to make a graph of the estimated data for the effect size. The I^2 index was used to show heterogeneity quantitatively. A P value less than 0.05 and an I^2 greater than 50% indicate significant statistical heterogeneity. In such instances, we utilized random-effects models for data analysis, which are better equipped to handle heterogeneity. Additionally, we conducted a sensitivity analysis to determine whether our results were influenced by a specific study. This approach ensured the robustness and reliability of our findings.

Publication bias was not evaluated due to the small number of the trials. The Comprehensive Meta-Analysis (CMA) software V.2 was used for all analyses. The results of women's satisfaction with VR were reported as a qualitative synthesis.

Results

Characteristics of the Included Studies

After the electronic search, out of 611 retrieved studies, 26 were evaluated after the initial screening process, and 7 were included in the meta-analysis (Figure 1). The publication dates of the articles were between 2015 and 2024, and 4 articles (57%) were published between 2023 and 2024,[1,25-27] which indicates that VR has recently been considered in episiotomy pain reduction. The characteristics of the articles included in the meta-analysis are shown in Table 1. The included articles were conducted in Iran (28.6%),[10,20] Turkey (28.6%),[1,25] Egypt (14.3%),[26] Ghana (14.3%),[19] and Israel (14.3%).[27] The sample size in the articles varied from 30[10,20] to 200[19] per study. The study design in 5 studies (71.4%) was a randomized control trial (RCT),[1,10,20,25,27] and 2 studies (28.6%) were quasi-experimental.[19,26]

The model of episiotomy repair was not stated in any of the articles except for the study by Şolt Kırca et al.[25] Among the articles included in the meta-analysis, 4 studies (57%) examined the amount of pain and anxiety,[19,25-27] two studies (28.6%) only examined the pain intensity[1,10] and one study examined anxiety.[20] In all the studies included in the meta-analysis, the control group received standard local anesthesia. In one study, another control group was considered to have skin-to-skin contact.[25] In Peleg's study, the type of care of the control group was not mentioned.[27]

Risk of Bias Assessment

In the assessment of the methodological quality of the included studies using the ROB tool, the quality of one study (14.3%) was reported as good (low risk of bias),[25] two studies (28.6%) were fair,[19,26] and four studies (57.1%) were poor[1,10,20,27] (Table 2). The biggest weakness in the qualitative evaluation of the studies was 'Allocation Concealment' and 'Blinding of participants and personnel[1,10,19,20,26,27] (Figure 2)

One study was low-risk in all domains,[25] and 71.4% of studies were low-risk of bias on selective reporting and incomplete results items.[1,19,25-27] In 71.4% of the studies, the 'Blinding of outcome assessment' was unclear.[1,10,19,20,26]

Pain intensity assessment

Six studies with a sample size of 548 women, who were equally allocated to the experimental and control groups, were included in the meta-analysis to investigate the level of pain.[1,10,19,25-27] Figure 3 presents the meta-analysis of the effect of VR on pain intensity during episiotomy repair. As compared to the control group, the women using VR experienced lower perineal pain during episiotomy repair for 1.622, which was statistically significant [MD (95% CI) = -1.622 (-2.598, -0.645), $P = 0.001$]. A random effect model was used because there was significant heterogeneity between studies (Cochrane's Q-value = 21.945, $I^2 = 81.772\%$, $P < 0.001$). Sensitivity analysis showed that the effect size was robust and not sensitive to any individual study.

Meta-analysis findings showed that the mean difference

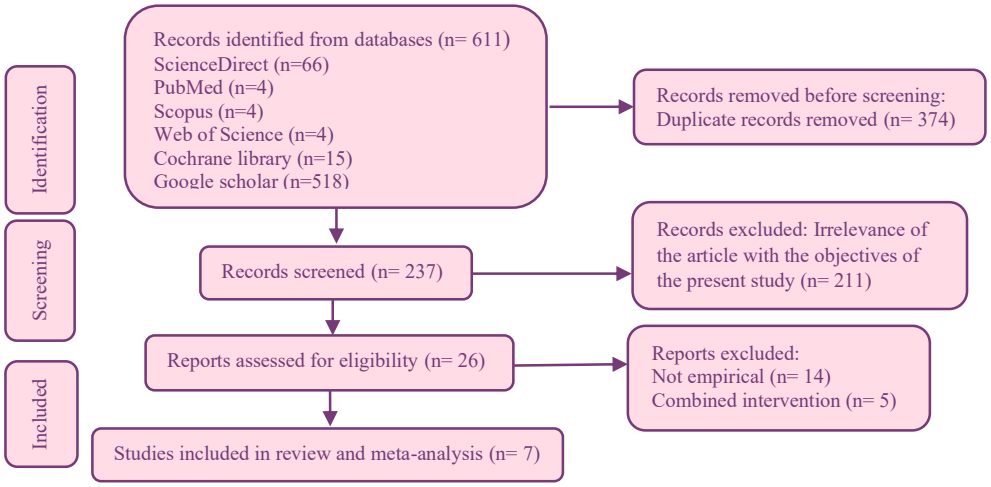

Figure 1. Flow diagram of the search process

in perineal pain intensity immediately after episiotomy repair was lower in the VR group, compared with that in the control groups, and this was statistically significant (Figure 4). In other words, the women who were in the intervention group reported 1.931 units less perineal pain immediately after the episiotomy repair compared to the control group [MD (95% CI) = -1.931 (-2.785, -1.076), $P < 0.0001$] (Figure 4). We found significant heterogeneity among the included studies (Cochrane's Q-value = 10.774, $P = 0.013$, $I^2 = 72.155\%$). The sensitivity analysis indicated that the effect size was resilient and did not hinge on the results of any single study.

Figure 5 shows the forest plot of the effect of VR on the amount of perineal pain intensity one hour after episiotomy repair. According to the findings of this figure, the amount of pain in the intervention group was less than the control group with a statistically significant difference [MD (95% CI) = -1.596 (-2.436, -0.765), $P < 0.001$]. Evidence of heterogeneity was achieved between studies (Cochrane's Q-value = 12.501, P = 0.006, $I^2 = 76.002\%$), therefor a random effect model was used. The sensitivity analysis revealed that the magnitude of the effect was sturdy and remained unaffected by the exclusion of any individual study.

Based on the presented results, VR during, immediately, and one hour after episiotomy repair has been able to significantly reduce the amount of perineal pain in the intervention group compared to the control group. Also, the level of pain intensity was qualitatively reported in 4 studies (57.1%) [1,10,19,26] (Table 3).

Assessment of Anxiety

Five studies with a sample size of 498 women, who were equally assigned to the experimental and control groups, were included in the meta-analysis to investigate the level of maternal anxiety. To investigate anxiety in 4 studies (80%), STAI (20-80)[20,25-27] was used, in one study[19] the Anxiety Rating Scale (0-10).

Figure 6 showed that the SMD of women's anxiety after episiotomy repair was significantly lower in the VR group compared with that in the control groups. This means that women in the intervention group had less anxiety than people in the control group after episiotomy repair [SMD (95% CI) = -1.48 (-2.451, -0.509), $P = 0.003$]. Evidence of heterogeneity was achieved between studies (Cochrane's Q-value = 83.84, $P < 0.001$, $I^2 = 95.229\%$). Sensitivity analysis showed that the effect size was robust and not sensitive to any single study.

Maternal Satisfaction with VR Application

The level of participants' satisfaction with VR was investigated in three studies.[1,19,26] The level of satisfaction was evaluated with various methods such as numerical VAS[1] and ranking methods.[19,26] According to the results of these studies, the level of satisfaction of the participants in the VR group was higher than that of the control group. In the study of Orhan and Bülez the mean (SD) in the intervention and control groups were 9.72 (0.61) and 7.06 (1.53),[1] respectively. Also, in the study of Mohamed-Nabil Aboushady et al 60% of the participants were satisfied with the VR application.[26] According to the results of Ahmed Osman Mohamed et al study, 92% of the participants were satisfied or highly satisfied with the use of VR.[19]

Quality of Evidence

We used GRADEpro GDT (Guideline Development Tool) to assess the quality of evidence for outcomes, and the results are shown in Table 4. The quality of evidence was moderate for perineal pain intensity one hour after episiotomy repair, and women's anxiety after episiotomy repair. They were given one downgrade by the serious inconsistency. The quality of evidence was low for perineal pain intensity during repair. It was given two downgrades by serious inconsistency and risk of bias. Finally, the evidence grading for the perineal pain intensity immediately after episiotomy repair was rated as very low because of serious risk of bias, inconsistency and imprecision.

Table 1. Characteristics of the articles included in the meta-analysis

Author/ Year; Country	Study type	Sample size	Sample characteristics	Intervention	Comparison	Tools	Outcome	Quality assessment
Orhan and Bülez [1] (2023); Turkey	RCT	50 (25 experimental, 25 control)	Primiparous, between the ages of 18 and 49, fluent in Turkish, not having problems with their hearing, vision, or perception, low pregnancy risk category without any complications of pregnancy (bleeding, not reliable fetal heart rate, etc.) at all phases of delivery, spontaneous delivery with a mediolateral episiotomy, without any diagnosis or history of psychological disorders, no signs of infection like swelling or redness in the uterus, and not being allergic to latex, Apgar score of 7 or higher, no birth defects, consent form filled out completely, and no headache.	Virtual glasses	Only anesthesia	VAS (0-10) for pain	VR glasses alleviated pain during episiotomies and enhanced women's satisfaction.	Poor
Jahani Shoorab et al[10] (2015); Iran	RCT	30 (15 experimental, 15 control group)	Primiparous Iranian woman with a low-risk pregnancy, no obstetric complications, spontaneous labor-associated episiotomy incision, no mental disease, addiction, nausea from movement, or headaches. The exclusion criteria included Apgar-score<7 during 1-5 minutes of delivery, neonatal abnormality, and lidocaine above 5 ml during episiotomy repair.	Audio-visual glasses	Local infiltration	Numeric Pain Rating Scale 0-100	The pain scores during episiotomy repair in the two groups varied statistically significantly.	Poor
Ahmed Osman Mohamed et al[19] (2022); Ghana	Quasi-experimental	200 (100 experimental, 100 control)	Primiparous, under 35 years old, singleton pregnancy, mediolateral episiotomy, ability to write and read, free of pregnancy high-risk conditions, prepared to take part in the research, and agreeing to the VR intervention	Virtual glasses	Anesthesia	NAS for pain-Anxiety Rating Scale	In primiparous women undergoing episiotomies, VR reduced pain and anxiety. They were also mostly satisfied with the VR application.	Fair
Jahani Shourab et al[20] (2016) Iran	RCT	30 (15 experimental, 15 control)	Primiparous Iranians, low-risk singleton pregnancy and giving birth without congenital defects, Apgar score 7–10, no mental illness or addiction, no motion sickness or headache, and literate	Audio-visual glasses	Local infiltration	Numerical Anxiety Scale (0-10), STAI Test (20-80)	Although scores for anxiety were not significantly different between the two groups (the use of video glasses compared to standard service), the intervention group had reduced anxiety levels during and after repair.	Poor
Şolt Kırca et al[25] (2023) Turkey	RCT	120 (VG 40, skin-to-skin 40, control group 40)	Primiparous, 20-40 years of age, singleton pregnancy, 37th-42nd gestational weeks, vaginal delivery, Medio lateral episiotomy, vertex presentation, APGAR score 7-10, not utilized a non-pharmacological technique, newborn weighing 2-4 kg, voluntary consent form	Virtual glasses	The standard hospital protocol or skin-to-skin contact	VAS (0-10) for pain-STAI (20-80) for anxiety	During episiotomy repairs, virtual glasses are of greater benefit than skin-to-skin contact and control procedures for diminishing pain and decreasing anxiety.	Good
Mohamed-Nabil Aboushady et al[26] (2023) Egypt	Quasi-experimental	100 (50 experimental, 50 control)	Primiparous, singleton fetus, gestational age (>37 up to 40 weeks of gestation), low risk of pregnancy without obstetric complications (hemorrhage, nonreasoning fetal heart rate) during labor, spontaneous vaginal delivery associated with episiotomy incision, no history of mental illness, addiction, motion sickness, and headache.	Virtual glasses	Standard local anesthesia	VAS (0-10) for pain - STAI (20-80) for anxiety	There were statistically significant differences between the two groups in terms of the length of the repair, the severity of the pain, and the degree of anxiety. Also, most of the study sample were satisfied with VR applications.	Fair
Peleg et al[27] (2024); Israel	RCT	88 (44 experimental, 44 control group)	Delivered women undergo episiotomy or perineal tear repair	VR	Without VR	VAS for pain - STAI for anxiety	VR reduced pain during episiotomy and perineal tear repair, but not anxiety.	Poor

VAS, Visual analogue scale; NAS, Numerical Analog Scale; STAI, Spielberger state-trait questionnaire.

Table 2. Risk of bias of included studies

Studies	Sequence generation	Allocation Concealment	Selective reporting	Incomplete results	Other bias	Blinding of participants and personnel	Blinding of outcome assessment	Overall
Cochrane Risk of Bias Assessment Tool for Randomized Studies								
Orhan & Bülez[1] (2023)	low	high	low	low	low	high	unclear	Poor
Jahani Shoorab et al[10] (2015)	high	high	high	unclear	low	high	unclear	Poor
Jahani Shourab et al[20] (2016)	low	high	high	unclear	low	high	unclear	Poor
Şolt Kırca et al[25] (2023)	low	low	low	low	low	low	low	Good
Peleg et al[27] (2024)	low	low	low	low	unclear	high	high	Poor
The Risk of Bias Assessment Tool for Non-randomized Studies (RoBANS)								
Studies	**Selection of participants**	**Confounding variables**	**Measurement of exposure**	**Blinding of outcome assessment**	**Incomplete outcome data**	**Selective outcome reporting**	**Overall**	
Ahmed Osman Mohamed et al[19] (2022)	low	low	low	unclear	low	low	Fair	
Mohamed-Nabil Aboushady et al[26] (2023)	low	low	low	unclear	low	low	Fair	

Low: low risk of bias, High: high risk of bias.

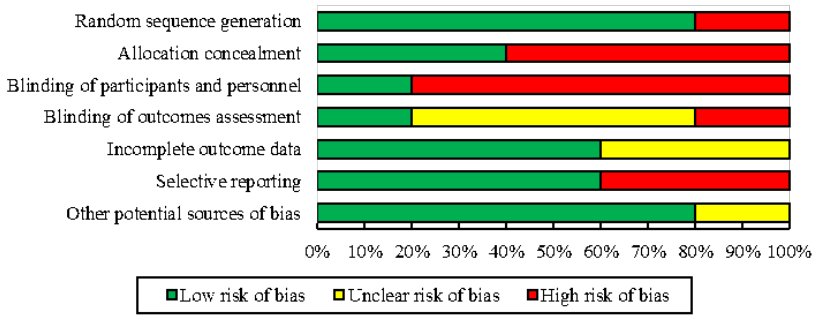

Figure 2. Risk of bias graph: review authors' judgments about each risk of bias domain presented as percentages across all included RCTs

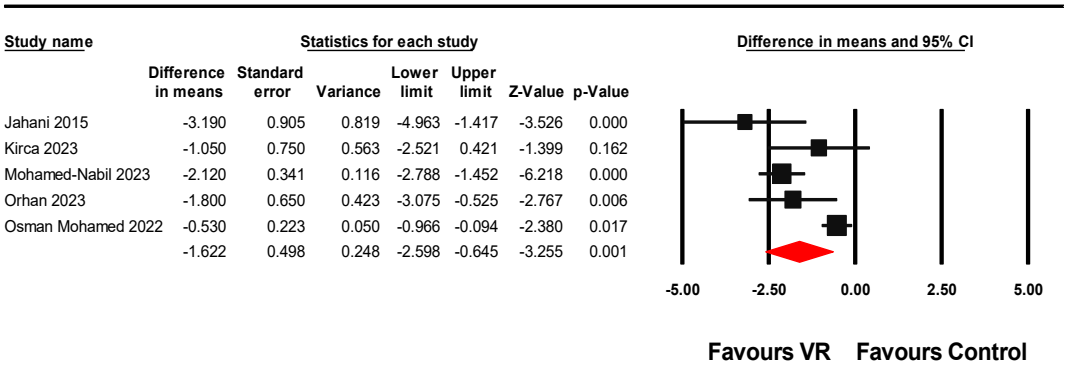

Figure 3. Forest plot of VR effect on pain intensity during episiotomy repair

Discussion

This study investigated the effect of using VR on women undergoing episiotomies. Our review found seven trials that met our criteria. Six studies considered pain intensity as an outcome variable, five articles assessed anxiety as an outcome variable, and three measured satisfaction levels following VR application. It was concluded that the VR modality can significantly reduce pain and anxiety and increase satisfaction in women undergoing episiotomy repair. The effects of VR devices have been investigated in a variety of fields of medicine, ranging from surgical instruction to pain control.[28] The utilization of modern technologies in medicine, such as VR, has altered during the past decade. VR technology is now being used in clinical settings,[28] therefore, more VR research is needed due to its increasing application in medicine.

According to the current meta-analysis, the VR group, as opposed to the control group, effectively reduced pain during, right afterward, and an hour after episiotomy. The usefulness of VR in treating acute pain brought on by

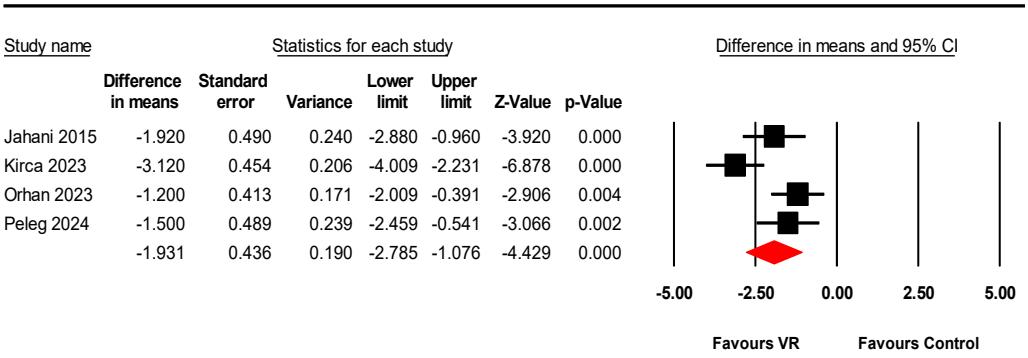

Figure 4. Forest plot of VR effect on perineal pain intensity immediately after episiotomy repair

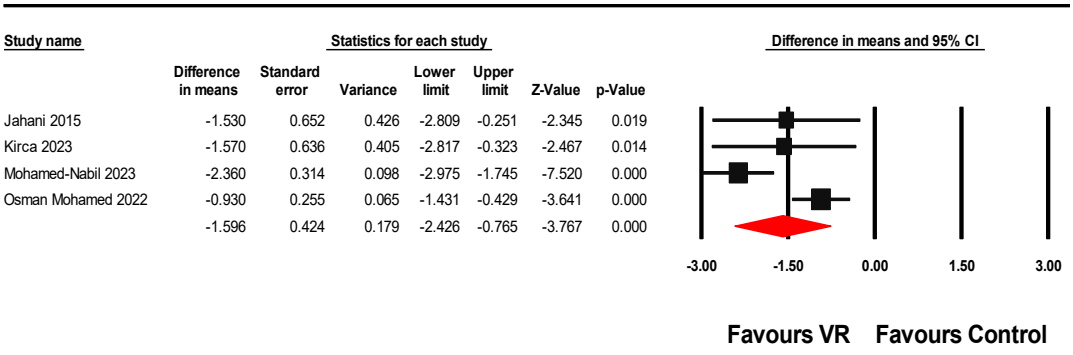

Figure 5. Forest plot of VR effect on perineal pain intensity one hour after episiotomy repair

Table 3. Pain severity levels in different stages of episiotomy

Author	Level of pain	No. (%)									
		Before repair		Internal repair		Skin repair		After repair		The first hour after the repair	
		VR	Control	VR	Control	VR	Control	VR	Control	VR	Control
Orhan and Bülez[1] (2023)	No	9 (36)	8 (32)	14 (56)	3 (12)	16 (64)	1 (4)	22 (88)	18 (72)	-	-
	Mild	13 (52)	13 (52)	7 (28)	15 (60)	4 (16)	13 (52)	2 (8)	5 (20)	-	-
	Moderate	3 (12)	4 (16)	4 (16)	7 (28)	5 (20)	11 (44)	1 (4)	2 (8)	-	-
	Chi-square (P)	0.202 (0.904)		10.845 (0.004)		20.250 (0.001)		2.69 (0.355)		-	
Jahani Shoorab et al[10] (2015)	No	1 (6.7)	5 (33.3)	3 (20.0)	1 (6.7)	3 (20.0)	1 (6.7)	9 (60.0)	6 (40.0)	7 (46.7)	5 (33.3)
	Mild	-	-	1 (6.7)	0 (0)	-	-	-	-	-	-
	Moderate	10 (66.7)	9 (60.0)	10 (66.7)	10 (66.7)	9 (60)	5 (33.3)	5 (33.3)	8 (53.3)	8 (53.3)	10 (66.7)
	Severe	4 (26.7)	1 (6.7)	1 (6.7)	4 (26.7)	3 (20.0)	9 (60.0)	1 (6.7)	1 (6.7)	-	-
	P	0.104		0.284		0.076		0.524		0.524	
Ahmed Osman Mohamed et al[19] (2022)	No	0	0	-	-	-	-	0	0	0	0
	Mild	0	0	-	-	-	-	0	0	0	0
	Moderate	22 (22)	21 (21)	-	-	-	-	60 (60)	26 (26)	67 (67)	30 (30)
	Sever	78 (78)	79 (79)	-	-	-	-	40 (40)	74 (74)	33 (33)	70 (70)
Mohamed-Nabil Aboushady et al[26] (2023)	Mild	-	-	24 (48)	7 (14)	-	-	-	-	29 (58)	10 (20)
	Moderate	-	-	21 (42)	36 (72)	-	-	-	-	17 (34)	34 (68)
	Sever	-	-	5 (10)	7 (14)	-	-	-	-	4 (8)	6 (12)

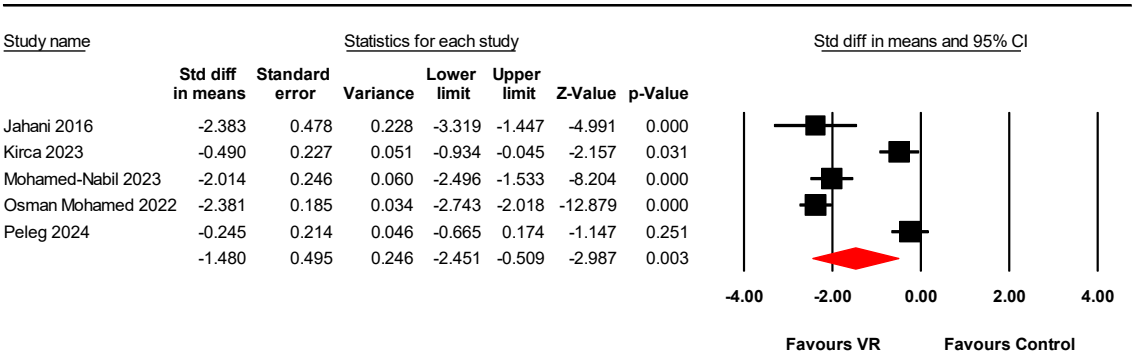

Figure 6. Forest plot of VR effect on women's anxiety 1 h after episiotomy repair

Table 4. GRADE evidence profiles for outcomes among the studies included in the meta-analysis

Certainty assessment							No. of patients		Effect (95% CI)		Certainty	Importance
N	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other	Intervention	Comparison	Relative	Absolute		
Pain intensity during episiotomy repair												
5	Randomised trials	Serious[a]	Serious[b]	Not Serious	Not Serious	None	230	230	-	MD 1.622 lower (2.598 lower to 0.645 lower)	⊕⊕◯◯ Low	Critical
Perineal pain intensity immediately after episiotomy repair												
4	Randomised trials	Serious[a]	Serious[b]	Not Serious	Not Serious[c]	None	124	124	-	MD 1.931 lower (2.785 lower to 1.076 lower)	⊕◯◯◯ Very Low	Critical
Perineal pain intensity one hour after episiotomy repair												
4	Randomised trials	Not Serious	Serious[b]	Not Serious	Not Serious	None	205	205	-	MD 1.596 lower (2.436 lower to 0.765 lower)	⊕⊕⊕◯ Moderate	Important
Women's anxiety one hour after episiotomy repair												
5	Randomised trials	Not Serious	Serious[b]	Not Serious	Not Serious	None	249	249	-	SMD 1.48 SD lower (2.451 lower to 0.509 lower)	⊕⊕⊕◯ Moderate	Important

CI: Confidence interval; MD: Mean difference; SMD: Standardized mean difference
[a] The number of studies with high bias risk was high.
[b] High heterogeneity exists.
[c] The optimal information size (OIS) criterion is not met.

medical procedures, wound cleaning, and experimental pain has been emphasized in several systematic reviews,[29-31] but no meta-analysis has specifically addressed episiotomy repair. This distinction is crucial because women who are giving birth may be much more influenced by the discomfort of medical procedures and may have a unique VR experience.

Distraction was the main focus of a meta-analysis on VR in pediatrics. Large effect sizes suggest that VR is a useful distraction technique to lessen discomfort in pediatrics undergoing a range of medical procedures.[32] VR is thought to be a better option than conventional techniques of distraction, such as pleasant imagining, rhythmic cognitive activities, the external focus of attention, and neutral imagining. Due to its immersive quality, which encompasses a patient's auditory and visual processing as well as physical movements, which require more attention in theory.[33,34] According to a meta-analysis in 2019, the effectiveness of VR in treating shoulder impingement syndrome and persistent neck pain seems promising. Rheumatoid arthritis, osteoarthritis of the knee, ankle instability, and post-anterior cruciate reconstruction all respond similarly to VR and physical activity.[35] According to the results of the current study, the VR group's anxiety during episiotomy was effectively reduced in comparison to the control group. Even though there are various

reports on VR's usefulness for pain[36,37] its ability to reduce anxiety has received little attention. This is noteworthy because anxiety can make pain worse.[38] The results of our study confirm previous investigations documented in the existing body of knowledge. The results of a meta-analysis study in 2020 demonstrate that VR is a useful distraction method to lessen pain and anxiety in patients undergoing a variety of dental treatments; however, due to the lack of studies in this area, it is necessary to conduct additional studies regarding VR as a method for preparing clients for dental procedures.[39] The results of a prior meta-analysis conducted in 2008 suggested that VR has large effect sizes compared to controls, may be more appealing to patients, and is more widely available.[40] In another meta-analysis conducted by Koo et al preoperative anxiety was significantly reduced in the VR group than in the control group.[41] A recent meta-analysis suggested that VR may be more beneficial than other non-pharmacological techniques, even though the advantages of VR in comparison with different non-pharmacological methods regarding their effect on preoperative anxiety remain unknown.[42] When comparing the findings of prior meta-analyses, VR had a higher effect on anxiety (1.32 vs. 0.61 or 0.35) than music or gaming.[42-44] However, more investigation is needed to clearly define the advantages of VR over alternative approaches.

It is currently not possible to compare effect sizes for VR preparation to other types of preparative interventions that minimize pain and anxiety in the context of episiotomy because VR use as a preparation aid for medical operations is a relatively unexplored field of research.

Based on the results of these studies, participants in the VR group were more satisfied than those in the control group. Ahern et al meta-analysis of VR's efficacy for managing spinal pain revealed statistically significant but not clinically significant increases in client satisfaction over traditional proprioceptive education.[45] Different populations in the two studies could have explained the variation in results. This study examined RCTs to determine the potency of VR in alleviating spinal pain in male or female adolescents or adults aged 12 to 80 with acute, subacute, or chronic pain.

In the included studies, the weaknesses in the qualitative evaluation of the studies were allocation concealment' and 'blinding of participants and personnel'. In only one reviewed study, participants and treatment providers were included, resulting in low-risk bias.[25] In all seven RCTs included in the meta-analysis by Ahern et al the quality of the evidence ranged from very low to low quality.[45] Another meta-analysis revealed fourteen studies, had high quality, eight studies had moderate quality, and four studies had poor quality. Therefore, a sensitivity analysis was performed by excluding studies with low methodological quality.[32] It would be desirable to perform additional RCTs with a reduced risk of bias to improve the overall quality of the evidence, particularly in the areas of random sequence generation, allocation concealment, and blinding of participants and personnel.

We know that no single method has been confirmed to precisely evaluate the meta-analysis' effect estimates' certainty. Therefore, to assess the certainty of the evidence, we followed the GRADE Working Group recommendations.[24] The quality of evidence was moderate for perineal pain intensity one hour after episiotomy repair, and women's anxiety after episiotomy repair. This suggests that while the data is reasonably consistent, further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate and The quality of evidence was very low to low for other varriables (pain duriong and intensity immediately after episiotomy repair). This indicates that the evidence for these variables is limited and has less certainty. The lower quality of evidence for these variables could be due to various factors such as potential biases in the studies. Therefore, the conclusions drawn for these variables should be interpreted with caution. Further research, preferably well-designed RCTs are needed to provide more robust and reliable evidence for these variables. This will help to ensure that the interventions and treatments being recommended are based on the best available evidence. It is also important to consider patient values and preferences, as well as the clinical context, when interpreting and applying these findings in practice.

Strengths and Limitations of the Study

We believe this is the first study to completely review and assess VR's efficacy in episiotomy procedures. Limitations should be highlighted, including a lot of heterogeneity, such as clinical: differences in participants, interventions, or outcomes; methodological: differences in study design; risk of bias; and statistical: variation in intervention effects or results. Since this investigation's objective was to determine the effectiveness of VR on all outcomes during and after episiotomy, the authors were only able to analyze the three variables of pain, anxiety, and satisfaction because there were not enough studies that examined other variables. Future research must also examine a larger spectrum of significant outcomes from VR applications, like fear and stress.

Despite a comprehensive search, only a few eligible studies were found, which prevents this study from reaching definitive conclusions. To obtain more accurate conclusions, higher-quality clinical research must be conducted in the future. Additionally, more research is required to establish the ideal period for achieving the desired outcomes in VR applications at various degrees of immersion. Such a study can assist in modifying VR treatment techniques to maximize their therapeutic benefits. The double-blind screening of the literature, consensus meetings, when necessary, consultation with many databases to properly represent the available

research, and other strengths of this systematic review ensure a low risk of potential bias. There are also no time or language limitations.

Conclusion

Women who underwent episiotomies showed statistically and clinically significant reductions in their level of anxiety and pain during, immediately after, and one hour following the procedure. However, more comprehensive, higher-quality research is still needed to determine the efficacy and effectiveness of VR for episiotomies. The findings of this study can be applied to the broad usage of VR for pregnant women undergoing birthing and episiotomies in maternity hospitals.

Acknowledgments

The authors are grateful to the researchers whose publications were used to write this article.

Authors' Contribution

Conceptualization: Mona Larki, Zahra Hadizadeh Talasaz.
Data curation: Elham Manouchehri, Somayeh Makvandi, Zahra Hadizadeh Talasaz, Elham Azmoude, Mona Larki.
Formal analysis: Somayeh Makvandi, Zahra Hadizadeh Talasaz.
Investigation: Elham Manouchehri, Somayeh Makvandi, Zahra Hadizadeh Talasaz, Elham Azmoude, Mona Larki.
Methodology: Mona Larki, Elham Manouchehri.
Project administration: Mona Larki.
Resources: Elham Manouchehri, Somayeh Makvandi, Zahra Hadizadeh Talasaz, Elham Azmoude, Mona Larki.
Software: Somayeh Makvandi.
Supervision: Mona Larki.
Validation: Elham Manouchehri, Somayeh Makvandi, Zahra Hadizadeh Talasaz, Elham Azmoude, Mona Larki.
Visualization: Somayeh Makvandi, Zahra Hadizadeh Talasaz, Elham Azmoude.
Writing–original draft: Elham Manouchehri, Somayeh Makvandi, Mona Larki.
Writing–review & editing: Elham Manouchehri, Somayeh Makvandi, Mona Larki.

Competing Interests

There is nothing to declare.

Data Availability Statement

All data generated or analyzed during this study are included in this published article.

Ethical Approval

The Mashhad University of Medical Sciences ethics committee provided the research's ethics code (IR.MUMS.NURSE.REC.1402.085). Consent to participate is not applicable.

Funding

The Mashhad University of Medical Sciences provided funding for this study.

Supplementary Files

Supplementary file 1. Search strategy.

Research Highlights

What is the current knowledge?

- Recently, the number of studies on how virtual reality (VR) affects various clinical procedures has increased. No meta-analysis study has yet to investigate its effects on episiotomy repair.

What is new here?

- The VR significantly reduced perineal pain and anxiety during episiotomy repair, and also significantly increased satisfaction compared to the control group.

References

1. Orhan M, Bülez A. The effect of virtual reality glasses applied during the episiotomy on pain and satisfaction: a single blind randomized controlled study. J Pain Res. 2023; 16: 2227-39. doi: 10.2147/jpr.S412883
2. Deyaso ZF, Chekole TT, Bedada RG, Molla W, Uddo EB, Mamo TT. Prevalence of episiotomy practice and factors associated with it in Ethiopia, systematic review and meta-analysis. Womens Health (Lond). 2022; 18: 17455057221091659. doi: 10.1177/17455057221091659
3. Ye J, Chen Y, Yang H, Chen Q, Huang Y, Zhao J, et al. A nationwide cross-sectional survey of episiotomy practice in China. Lancet Reg Health West Pac. 2022; 19: 100345. doi: 10.1016/j.lanwpc.2021.100345
4. Radnia N, Khansari S, Jiriaei N, Hosseini SA, Salemi L, Hamoon M. The relationship between perineal size and episiotomy during delivery. J Med Life. 2022; 15(11): 1379-83. doi: 10.25122/jml-2021-0390
5. do Carmo Leal M, de Azevedo Bittencourt S, Esteves-Pereira AP, da Silva Ayres BV, de Araújo Silva LB, Thomaz E, et al. Progress in childbirth care in Brazil: preliminary results of two evaluation studies. Cad Saude Publica. 2019; 35(7): e00223018. doi: 10.1590/0102-311x00223018
6. Berkowitz LR, Foust-Wright C, Lickwood C, Eckler K. Approach to Episiotomy. UpToDate; 2016. Available from: https://medilib.ir/uptodate/show/4478.
7. Linowes J. Unity 2020 Virtual Reality Projects: Learn VR Development by Building Immersive Applications and Games with Unity 2019.4 and Later Versions. 3rd ed. Britain: Packt Publishing Ltd; 2020.
8. Şolt Kırca A, Kanza Gül D. The effect of music and skin contact with the newborn on pain and anxiety during episiotomy repair in primiparous women: a double-blind randomized controlled study. Explore (NY). 2022; 18(2): 210-6. doi: 10.1016/j.explore.2020.11.007
9. Koyyalamudi V, Sidhu G, Cornett EM, Nguyen V, Labrie-Brown C, Fox CJ, et al. New labor pain treatment options. Curr Pain Headache Rep. 2016; 20(2): 11. doi: 10.1007/s11916-016-0543-2
10. Jahani Shoorab N, Ebrahimzadeh Zagami S, Nahvi A, Mazluom SR, Golmakani N, Talebi M, et al. The effect of virtual reality on pain in primiparity women during episiotomy repair: a randomize clinical trial. Iran J Med Sci. 2015; 40(3): 219-24.
11. Li A, Montaño Z, Chen VJ, Gold JI. Virtual reality and pain management: current trends and future directions. Pain Manag. 2011; 1(2): 147-57. doi: 10.2217/pmt.10.15
12. Micheluzzi V, Casu G, Sanna GD, Canu A, Iovino P, Caggianelli G, et al. Improving adherence to rehabilitation for heart failure patients through immersive virtual reality (VIRTUAL-HF): a protocol for a randomized controlled trial.

Contemp Clin Trials. 2024; 138: 107463. doi: 10.1016/j.cct.2024.107463
13. Buche H, Michel A, Piccoli C, Blanc N. Contemplating or acting? Which immersive modes should be favored in virtual reality during physiotherapy for breast cancer rehabilitation. Front Psychol. 2021; 12: 631186. doi: 10.3389/fpsyg.2021.631186
14. Cowles S, Norton TJ, Hannaford KE, Foley M. Virtual reality for pain control during labor: patient preferences [14S]. 2019; 133: 206S. doi: 10.1097/01.Aog.0000559466.63150.51
15. Noben L, Goossens S, Truijens SE, van Berckel MM, Perquin CW, Slooter GD, et al. A virtual reality video to improve information provision and reduce anxiety before cesarean delivery: randomized controlled trial. JMIR Ment Health. 2019; 6(12): e15872. doi: 10.2196/15872
16. Frey DP, Bauer ME, Bell CL, Low LK, Hassett AL, Cassidy RB, et al. 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. Anesth Analg. 2019; 128(6): e93-6. doi: 10.1213/ane.0000000000003649
17. Thompson T, Terhune DB, Oram C, Sharangparni J, Rouf R, Solmi M, et al. The effectiveness of hypnosis for pain relief: a systematic review and meta-analysis of 85 controlled experimental trials. Neurosci Biobehav Rev. 2019; 99: 298-310. doi: 10.1016/j.neubiorev.2019.02.013
18. Morris LD, Louw QA, Crous LC. Feasibility and potential effect of a low-cost virtual reality system on reducing pain and anxiety in adult burn injury patients during physiotherapy in a developing country. Burns. 2010; 36(5): 659-64. doi: 10.1016/j.burns.2009.09.005
19. Ahmed Osman Mohamed H, Yehia Moustafa Sweelam M, Mohamed SH, Mohamed Abd-Aziz Abuzaid A, Kamal Abd Elkhalek N, Hassan AbdElfattah Mohamed N. Effect of virtual reality application on pain and anxiety among primiparous women with episiotomy. Egypt J Health Care. 2022; 13(2): 625-39. doi: 10.21608/ejhc.2022.233172
20. Jahani Shourab N, Ebrahimzadeh Zagami S, Golmakhani N, Mazlom SR, Nahvi A, Pabarja F, et al. Virtual reality and anxiety in primiparous women during episiotomy repair. Iran J Nurs Midwifery Res. 2016; 21(5): 521-6. doi: 10.4103/1735-9066.193417
21. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Int J Surg. 2021; 88: 105906. doi: 10.1016/j.ijsu.2021.105906
22. Higgins JP, Green S. Cochrane Handbook for Systematic Reviews of Interventions. The Cochrane Collaboration; 2008. doi: 10.1002/9780470712184
23. Kim SY, Park JE, Lee YJ, Seo HJ, Sheen SS, Hahn S, et al. Testing a tool for assessing the risk of bias for nonrandomized studies showed moderate reliability and promising validity. J Clin Epidemiol. 2013; 66(4): 408-14. doi: 10.1016/j.jclinepi.2012.09.016
24. Guyatt GH, Oxman AD, Schünemann HJ, Tugwell P, Knottnerus A. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. J Clin Epidemiol. 2011; 64(4): 380-2. doi: 10.1016/j.jclinepi.2010.09.011
25. Şolt Kırca A, Güdücü N, İkiz B. The effect of virtual glasses application on pain and anxiety during episiotomy repair: randomized controlled trial. Pain Manag Nurs. 2023; 24(5): e123-30. doi: 10.1016/j.pmn.2023.06.004
26. Mohamed-Nabil Aboushady R, Fawzy Abbas Soliman H, El- Sayed El-Sayed Amr T, Mohamed Ebrahim Abd Elnabi M. Effect of new modality application during episiotomy repair on pain, anxiety, and satisfaction among primiparous women. Egypt J Health Care. 2023; 14(2): 389-406. doi: 10.21608/ejhc.2023.295784
27. Peleg D, Yassin R, Ben Shachar I, Warsof S. 862 Virtual reality for pain reduction during episiotomy and perineal tear repair. Am J Obstet Gynecol. 2024; 230(1): S457. doi: 10.1016/j.ajog.2023.11.886
28. Li L, Yu F, Shi D, Shi J, Tian Z, Yang J, et al. Application of virtual reality technology in clinical medicine. Am J Transl Res. 2017; 9(9): 3867-80.
29. Garrett B, Taverner T, Masinde W, Gromala D, Shaw C, Negraeff M. A rapid evidence assessment of immersive virtual reality as an adjunct therapy in acute pain management in clinical practice. Clin J Pain. 2014; 30(12): 1089-98. doi: 10.1097/ajp.0000000000000064
30. Chan E, Foster S, Sambell R, Leong P. Clinical efficacy of virtual reality for acute procedural pain management: a systematic review and meta-analysis. PLoS One. 2018; 13(7): e0200987. doi: 10.1371/journal.pone.0200987
31. Malloy KM, Milling LS. The effectiveness of virtual reality distraction for pain reduction: a systematic review. Clin Psychol Rev. 2010; 30(8): 1011-8. doi: 10.1016/j.cpr.2010.07.001
32. Tas FQ, van Eijk CA, Staals LM, Legerstee JS, Dierckx B. Virtual reality in pediatrics, effects on pain and anxiety: a systematic review and meta-analysis update. Paediatr Anaesth. 2022; 32(12): 1292-304. doi: 10.1111/pan.14546
33. Johnson MH. How does distraction work in the management of pain? Curr Pain Headache Rep. 2005; 9(2): 90-5. doi: 10.1007/s11916-005-0044-1
34. Mahrer NE, Gold JI. The use of virtual reality for pain control: a review. Curr Pain Headache Rep. 2009; 13(2): 100-9. doi: 10.1007/s11916-009-0019-8
35. Gumaa M, Rehan Youssef A. Is virtual reality effective in orthopedic rehabilitation? A systematic review and meta-analysis. Phys Ther. 2019; 99(10): 1304-25. doi: 10.1093/ptj/pzz093
36. Pourmand A, Davis S, Marchak A, Whiteside T, Sikka N. Virtual reality as a clinical tool for pain management. Curr Pain Headache Rep. 2018; 22(8): 53. doi: 10.1007/s11916-018-0708-2
37. Won AS, Bailey J, Bailenson J, Tataru C, Yoon IA, Golianu B. Immersive virtual reality for pediatric pain. Children (Basel). 2017; 4(7): 52. doi: 10.3390/children4070052
38. Woo AK. Depression and anxiety in pain. rev pain. 2010;4(1):8-12. doi: 10.1177/204946371000400103
39. López-Valverde N, Muriel Fernández J, López-Valverde A, Valero Juan LF, Ramírez JM, Flores Fraile J, et al. Use of virtual reality for the management of anxiety and pain in dental treatments: systematic review and meta-analysis. J Clin Med. 2020; 9(4): 1025. doi: 10.3390/jcm9041025
40. Powers MB, Emmelkamp PM. Virtual reality exposure therapy for anxiety disorders: a meta-analysis. J Anxiety Disord. 2008; 22(3): 561-9. doi: 10.1016/j.janxdis.2007.04.006
41. Koo CH, Park JW, Ryu JH, Han SH. The effect of virtual reality on preoperative anxiety: a meta-analysis of randomized controlled trials. J Clin Med. 2020; 9(10): 3151. doi: 10.3390/jcm9103151
42. Eijlers R, Utens E, Staals LM, de Nijs PF, Berghmans JM, Wijnen RM, et al. Systematic review and meta-analysis of virtual reality in pediatrics: effects on pain and anxiety. Anesth Analg. 2019; 129(5): 1344-53. doi: 10.1213/ane.0000000000004165
43. Klassen JA, Liang Y, Tjosvold L, Klassen TP, Hartling L. Music for pain and anxiety in children undergoing medical

procedures: a systematic review of randomized controlled trials. Ambul Pediatr. 2008; 8(2): 117-28. doi: 10.1016/j.ambp.2007.12.005

44. Uman LS, Birnie KA, Noel M, Parker JA, Chambers CT, McGrath PJ, et al. Psychological interventions for needle-related procedural pain and distress in children and adolescents. Cochrane Database Syst Rev. 2013; (10): CD005179. doi: 10.1002/14651858.CD005179.pub3
45. Ahern MM, Dean LV, Stoddard CC, Agrawal A, Kim K, Cook CE, et al. The effectiveness of virtual reality in patients with spinal pain: a systematic review and meta-analysis. Pain Pract. 2020; 20(6): 656-75. doi: 10.1111/papr.12885