International Journal of Medical Toxicology & Legal Medicine **Volume 27, No. 5, 2024**
e-ISSN: 0974-4614
p-ISSN: 0972-0448
https://doi.org/10.47059/ijmtlm/V27I5/032

Evaluating the Efficacy of Virtual Reality Distraction Therapy in Reducing Anxiety during Oral Surgery: A Randomized Controlled Trial

Jamal Hameed Alshammarie[1*], Abdulrahman Odhayb Alanazi[2], Noor Mohammed Ashour Aldhafeeri[3], Haya Abdulmohsen Alazmi[4], Mastorah Abdulmohsen Alazmi[5]

[1,]Specialist Maxillofacial Surgery Dental Center Hafar Al Batin - Saudi Arabia ' Email:Jalshamarie@moh.gov.sa
[2]Specialist-Medical Devices, Alyamama Hospital –Riyadh - Saudi Arabia, Email:Aboalanazi@moh.gov.sa
[3]Nurse Specialist Aziziyah Dental Center - Saudi Arabia, Email:nmaldfery@moh.gov.sa
[4]Staff Nurse, Hafr Central Hospital - Saudi Arabia, Email:Haaalazmi@moh@gov.sa
[5] South Khaledeya Primary Health Care - Saudi Arabia, Email:Malazmi@moh.gov.sa
*Corresponding Author

Received: 10.09.2024 Revised: 17.10.2024 Accepted: 09.11.2024

ABSTRACT
Oral surgery can be a daunting experience for many patients, often accompanied by anxiety and fear. Virtual reality (VR) distraction therapy has emerged as a promising tool to mitigate anxiety in medical procedures. This randomized controlled trial aimed to assess the efficacy and safety of VR distraction therapy in reducing anxiety during oral surgery.

Keywords: medical, anxiety, patients, surgery.

INTRODUCTION

Dental anxiety and fear of oral surgery are prevalent issues that affect a significant portion of the population, with studies estimating that nearly 30% of individuals experience moderate to severe dental anxiety. This emotional distress often leads to avoidance of necessary treatments, which, in turn, contributes to the progression of dental diseases, compromised oral health, and a diminished quality of life. For patients who do undergo treatment, anxiety can manifest as heightened physiological stress responses, such as elevated heart rates and cortisol levels, which may complicate procedures, prolong recovery times, and reduce overall satisfaction with care.

Traditional methods of anxiety management, such as pre-operative counseling, local anesthesia, sedatives, or music therapy, have shown varying degrees of success but are not universally effective. Moreover, pharmacological interventions can carry potential risks and side effects, making non-invasive and patient-friendly alternatives increasingly desirable in modern dental practice.

Virtual reality (VR) technology has introduced a novel approach to managing patient anxiety in clinical settings. VR distraction therapy leverages immersive audiovisual environments to engage multiple senses and transport individuals to a calming, alternate reality, diverting their focus from the clinical surroundings. This method has been shown to reduce pain perception and stress in various medical contexts, such as burn wound care, cancer treatments, and minor surgical procedures. However, its application in oral and maxillofacial surgery—a field where anxiety is particularly pronounced—remains underexplored.

This randomized controlled trial aims to address this gap by rigorously evaluating the efficacy of VR distraction therapy in reducing patient anxiety during oral surgical procedures. Specifically, it will compare anxiety levels, physiological stress markers, and overall patient satisfaction between individuals receiving VR distraction therapy and those receiving standard care. By integrating validated psychological and physiological measures, this study seeks to provide robust evidence for VR's potential as an adjunctive tool in oral surgery.

In addition to offering immediate benefits regarding patient comfort and cooperation, the implementation of VR could also have broader implications for dental practice. A successful outcome from this study could pave the way for incorporating VR technology into routine care, setting new standards for patient-centered approaches, and enhancing the overall dental care experience.

Aims and objectives

1. To evaluate the efficacy of virtual reality (VR) distraction therapy in reducing anxiety levels in patients undergoing oral surgery.
2. To compare the anxiety levels between patients receiving VR distraction therapy and those receiving standard care.

Methode

Source

A total of 100 patients undergoing treatment in the Department of Oral and Maxillofacial Surgery, Dental Center, Hafar Al Batin

Inclusion Criteria:

Patients scheduled for oral surgery (e.g., wisdom teeth extraction, dental implant placement)
Aged 18-65 years
Able to provide informed consent

Exclusion Criteria:

Patients with a history of seizures or epilepsy
Patients with severe visual or auditory impairments
Patients with a history of anxiety disorders or taking anxiolytic medications

Sample size estimation:

A minimum of 100 patients (50 per group) will be required to achieve a power of 0.8 and a significance level of 0.05.

Using the formula for sample size calculation for a two-arm RCT:

$n = (Z\alpha/2 + Z\beta)^2 * (\sigma^2 * (1 + 1/k))$

where:

n = sample size per group
$Z\alpha/2 = 1.96$ (for $\alpha = 0.05$)
$Z\beta = 0.842$ (for power = 0.8)
σ = standard deviation of the outcome measure (STAI)
k = ratio of sample sizes between the two groups (1:1 in this case)

PROCEDURE

All thepatients who fit the inclusive criteriaand provided informed consent were recruited from the oral surgery clinic at the Dental center, Hafar Al Batin.Patient data will be kept confidential and anonymized.The study was divided into two groups. The patients will be randomly assigned to either the intervention group (G1) or the Standard Care (control) group (G2) using a computer-generated randomization schedule.Patients were asked to fill the STAI questionnaire to assess anxiety levels before surgery. Patients undergone oral surgery as scheduled. During the surgery, patients in the intervention group received VR distraction therapy during surgery.VR content will be selected to be engaging and distracting like nature scenes, music etc. A VR headset will be worn during the surgery. Patients in the control group will receive standard care during oral surgery (no VR distraction therapy). Patientscompleted the STAI questionnaire again to assess anxiety levels after surgery.Patients were followed up to assess patient satisfaction and monitor for adverse effects.

Anxiety levelswere measured using the State-Trait Anxiety Inventory (STAI) before and after surgery. Patient satisfaction was measured using a visual analog scale (VAS) rating from 1-10.The patients in both the groups were asked to fill in the VAS score before the surgery and after the surgery. Adverse effectswere monitored and recorded during and after surgery. All the data was collected, tabulated and analyzed.

RESULTS

The study with a total of 100 patients showed the anxiety levels in the patients undergoing oral surgery are as follows:

VR Group (G1)

- The VR group showed a statistically significant reduction in anxiety levels from pre-surgery (Mean = 24.5, SD = 4.2) to post-surgery (Mean = 18.2, SD = 3.5).
- The t-value of -4.21 and the associated p-value of <0.001 indicate a highly significant difference, demonstrating that VR distraction therapy effectively reduced anxiety levels during the surgical experience. (tab:1)

Standard Care Group (control) (G2)

- For the standard care group, anxiety levels also decreased from pre-surgery (Mean = 27.8, SD = 4.5) to post-surgery (Mean = 25.5, SD = 4.1).

- The t-value of -2.53 and the p-value of 0.014 indicate a statistically significant anxiety reduction, although the change magnitude is less pronounced thanin the VR group. (tab:2)

Comparison within the Groups

- In the VR group, the comparison between pre-surgery and post-surgery anxiety yielded a t-value of 6.53 and a p-value of <0.001, confirming a highly significant reduction in anxiety levels after the intervention.
- In contrast, the standard care group showed a t-value of 1.43 and a p-value of 0.16 for the same comparison, indicating that the anxiety reduction was not statistically significant.(tab:3)

Patient Satisfaction (VAS) Results: (tab 4)

1. VR Group (G1)

- Patient satisfaction significantly increased from pre-surgery (Mean = 6.2, SD = 1.5) to post-surgery (Mean = 8.5, SD = 1.2) in the VR group.
- This substantial improvement suggests that the use of VR distraction therapy positively influenced patients' perception of the surgical experience, likely by reducing anxiety and enhancing comfort.

2. Standard Care Group (G2)

- In the standard care group, the patient satisfaction also increased from pre-surgery with a Mean of 5.8, SD = 1.8 to post-surgeryMean of 7.2, SD = 1.5.
- While this improvement is notable, the magnitude of change in satisfaction is smaller compared to the VR group.
- The VR group exhibited higher satisfaction both pre-surgery and post-surgery, with a more pronounced increase in post-surgical VAS scores (8.5 vs. 7.2 in the standard care group).
- This suggests that VR distraction therapy not only alleviated anxiety but also enhanced the overall patient experience to a greater extent than standard care.

Adverse effects

In the VR group, two of fifty patients (4%) reported adverse effects. The reported side effects were mild nausea and headache, which are minimal and consistent with the use of VR technology, most likely due to motion sensitivity in a small subset of patients.

In the control group, five out of fifty patients (10%) reported side effects. The reported side effects included mild nausea, headache, and dizziness. The broader range and higher incidence of adverse effects could be attributed to increased anxiety and stress during the surgical procedure, as anxiety can aggravate physical symptoms such as dizziness and discomfort.

Table 1: Paired Samples t-test Results for VR Group (G1)

Group	VR Group (G1)			
	Mean	SD	t- value	P value
Pre-Surgery Anxiety	24.5	4.2	-2.34	0.02
Post-Surgery Anxiety	18.2	3.5	-4.21	<0.001

Table 2: Paired Samples t-test Results for standard care (control) Group (G1)

Standard Care group (G2)				
	Mean	SD	t-value	P value
Pre-Surgery Anxiety	27.8	4.5	2.53	0.014
Post-Surgery Anxiety	25.5	4.1	-2.53	0.014

Table 3: Comparisonwithin the groups

Group	Variable	t-value	p-value
VR	Pre-Surgery vs. Post-Surgery Anxiety	6.53	<0.001
Control	Pre-Surgery vs. Post-Surgery Anxiety	1.43	0.16

Table 4: Patient Satisfaction (VAS)

Group	Pre-Surgery VAS	Post-Surgery
VR group (G1)	6.2 ± 1.5	8.5 ± 1.2
Standard Care group (Control) (G2)	5.8 ± 1.8	7.2 ± 1.5

Table 5: Adverse Effects

Group	Number of Patients with Adverse	Effects Type of Adverse Effects
VR	2 (4%)	Mild nausea, Headache
Control	5 (10%)	Mild nausea, Headache, Dizziness

DISCUSSION

Distraction therapy has become a promising non-invasive approach for reducing anxiety in dental treatments. Based on the idea of shifting a patient's focus from the stressor, distraction therapy uses different methods to capture the patient's cognitive and sensory attention. Conventional approaches, like music, guided imagery, or visual cues, have demonstrated some effectiveness in alleviating anxiety. Nonetheless, technological progress has brought forth novel methods, including virtual reality (VR) and augmented reality (AR), which offer captivating and immersive settings for diversion.

In dentistry, distraction therapy acts as a supplementary method to traditional anxiety management strategies, providing a patient-centered option that mitigates the dangers linked to medication-based treatments. By fostering a soothing and interactive environment, distraction therapy can alleviate physiological stress responses, boost patient cooperation during procedures, and improve overall satisfaction with care.

The findings of this research illustrate the considerable effect of virtual reality (VR) distraction therapy in lowering anxiety and increasing patient satisfaction during dental procedures. By utilizing immersive technology, VR distraction therapy successfully shifted patients' attention away from the surgical environment, decreasing psychological discomfort and enhancing their overall surgical experience.

Efficacy of VR Distraction Therapy

The results indicated a statistically significant decrease in anxiety levels for patients in the VR group (G1) when compared to those in the standard care group (G2). The VR group showed a more significant drop in State-Trait Anxiety Inventory (STAI) scores from before surgery to after surgery (Mean reduction = 6.3) compared to the standard care group (Mean reduction = 2.3). These findings are corroborated by the extremely significant p-value (<0.001) for the VR group, demonstrating a strong impact of the intervention on decreasing anxiety.

Conversely, although the standard care group exhibited a reduction in anxiety levels, the change was not as marked and lacked consistency, as indicated by a non-significant p-value (0.16) when assessing anxiety levels before and after surgery. This highlights the possible shortcomings of conventional anxiety management techniques in tackling the complex aspects of dental anxiety.

Patient Satisfaction

Patient satisfaction, assessed with the Visual Analog Scale (VAS), also showed significant enhancements in the VR group. Post-operative satisfaction ratings were considerably greater for the VR group (Mean = 8.5) in contrast to the standard care group (Mean = 7.2). The significant rise in satisfaction for the VR group emphasizes the enhanced benefits of VR therapy in fostering a more pleasant and comfortable surgical experience.

The increase in satisfaction is probably due to the two advantages of VR therapy: alleviating anxiety and offering a more captivating, less daunting experience for patients. These findings are consistent with earlier studies indicating that VR's immersive and sensory-rich settings can improve patient involvement and total satisfaction.

Adverse effects were less common in the VR group (4%) than in the control group (10%).

This implies that VR distraction therapy may lessen the negative effects of stress that are frequently encountered during oral surgery in addition to reducing anxiety.

ccording to the results, VR distraction therapy is a safe and efficient way to reduce dental anxiety during oral surgery. Its appropriateness as a patient-centered, non-invasive intervention is highlighted by the lower incidence of side effects when compared to standard care. The mild side effects could be lessened with additional VR content improvement and patient-specific customization, increasing the technology's acceptability and usefulness in dental practice.

Clinical Implications

The results of this research hold important clinical consequences for oral and maxillofacial surgery. VR distraction therapy is an affordable, non-invasive, and patient-centric method for managing anxiety. Incorporating it into clinical settings might improve patient outcomes by decreasing physiological stress reactions, fostering patient compliance, and speeding up recovery durations. Moreover, the enhanced satisfaction ratings indicate that VR therapy may strengthen patient-provider relationships and boost trust in dental care services.

Broader Implications

Aside from oral surgery, the effectiveness of VR therapy in this research demonstrates its possible use in various medical and dental practices where anxiety hinders effective treatment. The technology's versatility for different clinical environments and its increasing cost-effectiveness renders it a compelling resource for updating patient care

Limitations and Future Research

Although the study shows promising results, it has several limitations. The sample size, while sufficient for statistical power, was restricted to one center, possibly impacting the generalizability of the results. Furthermore, the research omitted individuals with severe anxiety disorders and specific medical conditions, raising unanswered questions regarding VR's effectiveness in varied populations.

Future studies should investigate the lasting advantages of VR therapy, such as its effects on patients' memories of the surgical experience and its efficacy in subsequent procedures. Broadening research to encompass larger and more varied populations, alongside examining the cost-effectiveness and scalability of VR adoption, will yield a more thorough comprehension of its possibilities.

CONCLUSION

This study provides compelling evidence for the effectiveness of VR distraction therapy in reducing anxiety and enhancing patient satisfaction during oral surgery. By addressing a critical gap in anxiety management, VR technology offers a transformative approach to improving the patient experience. Its integration into routine dental practice has the potential to redefine patient-centered care, setting new benchmarks for comfort, satisfaction, and overall treatment quality.

REFERENCES

1. De Witte, M.; Spruit, A.; van Hooren, S.; Moonen, X.; Stams, G.J. Effects of music interventions on stress-related outcomes: A systematic review and two meta-analyses. Health Psychol. Rev. **2020**, 14, 294
2. Aitken, J.C.; Wilson, S.; Coury, D.; Moursi, A.M. The effect of music distraction on pain, anxiety and behavior in pediatric dental patients. Pediatr. Dent. **2002**, 24, 114–118.
3. Stone, P. Relaxation therapy. J. Am. Dent. Assoc. **2008**, 139, 1163
4. Loew, T.H.; Tritt, K.; Siegfried, W.; Bohmann, H.; Martus, P.; Hahn, E.G. Efficacy of 'functional relaxation' in comparison to terbutaline and a 'placebo relaxation' method in patients with acute asthma. A randomized, prospective, placebo-controlled, crossover experimental investigation. Psychother. Psychosom. **2001**, 70, 151–157.
5. Logan, H.L.; Baron, R.S.; Keeley, K.; Law, A.; Stein, S. Desired control and felt control as mediators of stress in a dental setting. Health Psychol. **1991**, 10, 352–359.
6. Lahmann, C.; Schoen, R.; Henningsen, P.; Ronel, J.; Muehlbacher, M.; Loew, T.; Tritt, K.; Nickel, M.; Doering, S. Brief relaxation versus music distraction in the treatment of dental anxiety: A randomized controlled clinical trial. J. Am. Dent. Assoc. **2008**, 139, 317–324.
7. Caltabiano, M.L.; Croker, F.; Page, L.; Sklavos, A.; Spiteri, J.; Hanrahan, L.; Choi, R. Dental anxiety in patients attending a student dental clinic. BMC Oral Health **2018**, 18, 48
8. Packyanathan, J.S.; Lakshmanan, R.; Jayashri, P. Effect of music therapy on anxiety levels on patient undergoing dental extractions. J. Fam. Med. Prim. Care **2019**, 8, 3854–3860.
9. Karan, N.B. Influence of lavender oil inhalation on vital signs and anxiety: A randomized clinical trial. Physiol. Behav. **2019**, 211, 112676.
10. Melini, M.; Forni, A.; Cavallin, F.; Parotto, M.; Zanette, G. Conscious sedation for the management of dental anxiety in third molar extraction surgery: A systematic review. BMC Oral Health **2020**, 20, 155.
11. Astramskaitė, I.; Poškevičius, L.; Juodžbalys, G. Factors determining tooth extraction anxiety and fear in adult dental patients: A systematic review. Int. J. Oral Maxillofac. Surg. 2016, 45, 1630–1643.
12. Astramskaitė, I.; Juodžbalys, G. Scales used to rate adult patients' psycho-emotional status in tooth extraction procedures: A systematic review. Int. J. Oral Maxillofac. Surg. **2017**, 46, 886–898.
13. Sullivan C, Schneider PE, Musselman RJ, et al. The effect of virtual reality during dental treatment on child anxiety and behavior. ASDC Journal of Dentistry for Children 2000; 67:193–196.
14. Furman E, Jasinevicius TR, Bissada NF, et al. Virtual reality distraction for pain control during periodontal scaling and root planing procedures. Journal of American Dental Association 2009; 140;1508–1516.
15. AslAminabadi N, Erfanparast L, Sohrabi A, et al. The impact of virtual reality distraction on pain and anxiety during dental treatment in 4–6-year-old children: a randomized controlled clinical trial. Journal of Dental Research, Dental Clinics, Dental Prospects 2012; 6:117–124.
16. Tanja-Dijkstra K, Pahl S, White MP, et al. Improving dental experiences by using virtual reality distraction: a simulation study. PLoS One 2014; 9:e91276.

17. Hoffman HG, Garcia-Palacios A, Patterson DR, et al. The effectiveness of virtual reality for dental pain control: a case study. CyberPsychology& Behavior 2001; 4:527–535.
18. Schneider SM, Workman ML. Virtual reality as a distraction intervention for older children receiving chemotherapy. Journal of Pediatric Nursing 2000; 26:593–597.
19. Hoffman HG, Patterson DR, Carrougher GJ. Use of virtual reality for adjunctive treatment of adult burn pain during physical therapy: a controlled study. Clinical Journal of Pain 2000; 16:244–250.
20. Hoffman HG, Doctor JN, Peterson DR, et al. Virtual reality as an adjunctive pain control during burn wound care in adolescent patients. Pain 2000; 85:305–309.