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Virtual reality in pain relief during chronic wound dressing change

Realidade virtual no alívio da dor durante a troca de curativos de feridas crônicas

Realidad Virtual en el alivio del dolor durante el cambio de vendajes de heridas crónicas

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ABSTRACT

Objective: To assess the effect of virtual reality in pain relief during chronic wound dressing change. **Method:** This is an experimental study carried out with 17 participants, in a stomatherapy clinic in Ceará, Brazil, from June to December 2019, using the virtual reality glasses Oculus Go®. Sociodemographic and clinical information, as well as of lifestyle, and characteristics of the lesions were collected. A faces scale and a visual analogue scale were used for pain assessment, behavioral aspects assessment, satisfaction, and discomfort with Oculus Go®. The Chi-square, McNemar, and Wilcoxon tests were used. The study was approved under opinion No. 2.649.144/2019. **Results:** There was a reduction in pain during dressing change with Oculus Go®. Participants with Oculus Go® manifested less pain during ($p < 0.001$) and after ($p < 0.001$) dressing change; and had lower heart rate before ($p = 0.044$) and after ($p = 0.001$) the procedure. There were significant differences between groups in systolic ($p = 0.012$) and diastolic ($p = 0.004$) blood pressure values after dressing. Virtual reality did not cause any discomfort and participants were satisfied. **Conclusion:** Virtual reality showed positive effects in pain relief during chronic wound dressing change.

DESCRIPTORS

Virtual Reality; Imaging, Three-Dimensional; Pain; Wounds and Injuries; Patient Satisfaction.

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INTRODUCTION

Chronic wounds are injuries that often stagnate in the inflammatory phase or present an impaired proliferative phase, which promotes healing time increase, taking months or years[1]. Although being difficult to heal, an understanding of the underlying pathophysiology and specific attention can often lead to successful healing[2].

The prevalence of chronic wounds is constantly increasing and these wounds are often associated with significant pain, with a great impact on quality of life[3]. Studies show a prevalence between 0.16 and 1.2%[4,5] of people with chronic wounds. About 80% of people with wounds report some level of pain[6].

The pain experienced by people with chronic wounds is persistent, recalcitrant, and disabling,[7] and may even occur at rest, continuously or intermittently, and does not stop despite the use of commonly used analgesics[6].

People with chronic wounds feel more pain during dressing changes[8]. At the time of change, trauma in the removal of primary dressings for replacement, cleaning procedures, and repeated touches on the wound bed are factors that cause moderate to severe pain[9]. Mechanical manipulation during dressing replacement procedure stimulates nociceptors, which are sensitized through sensory receptors that respond to pressure and other mechanical stimuli present in the wound bed, and promote greater pain stimulus[9].

Thus, the experience of pain during dressing change is subjective and can be influenced by several psychological factors. A Brazilian study evaluating pain in chronic wounds during dressing change identified moderate throbbing pain, especially during removal of the previous dressing and cleaning of the wound bed[10].

Currently, many researchers focus mainly on analgesics and dressing materials to relieve pain[8]. However, this type of pain management requires the use of new treatment plans to achieve effective analgesia and reduce the need for analgesics, considering their side effects and possible interactions[11].

New efforts have been made to develop non-pharmacological therapies for pain modulation that affect psychological factors, including innovative emerging technologies, such as Virtual Reality (VR)[11,12], which has been identified as a technology with potential to serve as a non-pharmacological treatment for pain[13].

VR is a technological apparatus that promotes a human-virtual environment interaction, providing the users with a digital place where they can be placed and live a synthetic but realistic experience[12].

VR is characterized as a distraction approach, based on immersive and engaging psychology, with the ability to divert the attention of nociceptors, and consequently, of painful perceptions, through visual and auditory distraction, which makes users not pay attention to the pain stimulus, as they are immersed in another virtual scenario[14].

VR decreases cerebral cortex processing amplitudes after painful stimuli, which are related to early modulation of sensory stimuli, associated with the perception of nociceptive stimuli and pain processing. Thus, the objective of VR technology is to provide users with a sense of presence in a simulated environment and to produce an immersive experience that can distract the cortical processing of painful stimuli[13].

Generally, VR systems consist of hardware (headphones, glasses, gloves, computers, and mobile devices) and software that offer a VR environment in multiple contexts, such as beaches, forests, amusement parks, among others, making it a relevant low-cost and promising tool for pain management[12].

Studies consulted infer that VR was effective in relieving pain in people undergoing painful procedures, such as postoperative[15] and burns[16] dressing change. This shows the relevance of using new VR technologies that can contribute to "distract" nociceptors during dressing replacement and, thus, reduce pain levels.

However, there have been no studies so far on the impact or effectiveness of VR in pain relief during dressing change in adults with chronic wounds, which makes the development of publications essential, taking patients' well-being and a new autonomous strategy for health professionals to minimize pain into account. The study echoes the hypothesis that the use of VR during dressing change for chronic wounds favors pain relief.

The objective of the study is to assess the effect of virtual reality in pain relief during chronic wound dressing change.

METHOD

Design of Study

This is an experimental study with intra-subject comparison, of pre- and post-test design, with a crossover randomized and rotating comparative group aimed at evaluating the effect of VR. In this study, the effect desired is pain reduction during dressing change through the use of VR.

Scenario

The study was carried out in a stomatherapy clinic in the state of Ceará, Brazil. This clinic is a reference for 13 cities located in the area of Maciço de Baturité.

Population

The target population was represented by people with chronic wounds, who show a difficult healing process, exceeding six weeks, often painful and presenting complexity in pain relief[17].

Thus, the calculation for finite samples was performed, with the percentage of 1.2% being adopted, and 80%[6] of this was calculated to reach the expected frequency for the sample calculation (0.96%). Considering a margin of error of 5% and a confidence level of 95%, the N for subjects of the study was reached with 15 participants.

The study included people aged 18 years or over, with chronic wounds, mild, intense, or moderate pain, and who were available to attend the clinic on pre-established days.

Exclusion criteria were not having hearing acuity (deaf people) assessed using the Percentage Index of Speech Recognition (PISR)[18]; not having sufficient visual acuity

(people with low vision and non-sighted people) assessed using the Snellen chart; drowsiness; being under the influence of alcohol or drugs, and eye injuries. It should be noted that the use of corrective lenses did not preclude the use of the Oculus Go®, which is adaptable over the glasses, despite being designed to work better on people with perfect sight. In addition, problems with poor hearing ability have been solved by setting the maximum volume for the Oculus Go® sounds. After applying the eligibility criteria, 17 people participated in the study. There were no sample losses.

After considering the random and rotating sample, each individual was identified by a Greek letter (alpha, beta... omicron) to avoid codes that could be associated with the identification of each group. Two groups were set up (control and intervention) and each of these groups underwent two observations, one using VR and another without VR, characterizing the crossover.

At first, randomization was performed, in which each participant had a 50% chance of fitting into either of the two assembled groups, with the selection of each group being performed by the "random" option present in the software Excel 2019. Following the draw to define where each participant would be initially allocated, the dressing was performed according to the protocol of the clinic, with one of the groups using the device for VR and the other not using it. In the second moment, there was an inversion of the groups' members, with the participants of the intervention group becoming part of the control group and those from the control group being allocated to the intervention group. Thus, all subjects had the opportunity to participate in the intervention. The time between the two observations was seven days.

The intervention took place with the use of glasses reproducing three-dimensional image and stereophonic sound, the Oculus Go®, which have two screens with 2560 x 1440 resolution, LCD panels, lenses with the same field of view and 3D-integrated spatial audio causing the effect of sound immersion. Oculus Go® tracked the users' movements through computer vision, which allowed an immersive experience in heavenly and realistic places, such as: beaches (Wineglass Bay and 12 Apostles, both in Australia; Tropical Beach Escape, Philippines; Fern Bern and Fantail Falls, New Zealand), rural areas (Northern Lights, United States; Forest Creek, Germany; Rice Terraces, Philippines) and National Park (Glenn Canyon, United States), with 360° video images and location-specific spatial sounds. Each participant was previously consulted about the preferred scenario.

The time for changing dressings was chosen for the use of VR, considering that this is the moment of greatest pain intensity, due to wound handling[9,10]. It should be noted that patients did not receive analgesics before dressing changes and were instructed not to take analgesics 24 hours before going to the consultation, except in case of medical indication due to persistent pain.

The dressing was applied through an aseptic technique using surgical gloves. The clinic's own protocol was used. It included the removal of the dressings for replacement, wound bed cleaning with liquid solutions (0.9% saline solution and polyhexanide at room temperature), conservative instrumental debridement with a carbon scalpel blade no. 15, insertion of primary coverage and secondary occlusion of the lesion as indicated by a nurse specialized in stomatherapy and dermatology. All dressings were performed by the same nurse (not blinded to dressings and application of the intervention). The dressing changes took an average of 22 minutes. A second nurse was responsible for collecting the study data.

Data Collection

Data collection took place from June to December 2019 at the stomatherapy clinic, which has two rooms with good lighting and air conditioning equipment with remote control, to allow a standard temperature of 26ºC in all consultations.

A form was used with sociodemographic information (age, sex, race, occupation, education); clinical characteristics and lifestyle habits (diabetes mellitus, arterial hypertension, smoking, and alcoholism), characteristics of the lesions (skin type – healthy, very thin, dry, discolored, humid, or with edema); type of wound (venous ulcer, arterial ulcer, pressure ulcer, neurotrophic ulcer, diabetic foot, or other); appearance (necrotic, infected, granulated, or epithelialized); edge (erythema, heat, hardened, ruptured, scaly, or dry); edge detachment (present or absent); topical treatment (hydrogel, papain, calcium alginate, silver hydrofiber, collagenase, essential fatty acids, silver sulfadiazine, or other coatings without a component or medication with analgesic substance); and type of pain (non-cyclic acute – during debridement, cyclic acute – during dressing removal, and chronic pain – persistent and constant). All characteristics of the lesions were evaluated by a nurse specialized in stomatherapy and dermatology.

The Faces Pain Scale[19] was used to assess pain (none, mild, moderate, discomforting, intense and unbearable). Pain levels were measured by the Visual Analog Scale (VAS)[20] from zero to ten (0 = no pain and 10 = worst pain imaginable) two minutes before starting dressing application, after debridement and immediately after completion of the whole procedure. Another question regarded the greatest and least intensity of pain that the patient has felt in the last 24 hours. Clinical data (heart rate, systolic and diastolic blood pressure, temperature and oxygen saturation) were evaluated 60 seconds before starting the dressing and immediately after its completion. A qualitative assessment was performed of the behavioral aspects (presence or absence of vocal signs, typical painful facial expression, altered body movement, protective posture, and pain location) and physiological changes (paleness and sweating) during dressing.

Following dressings application completion, satisfaction when using the Oculus Go® during the procedure was assessed with a five-point Likert-type scale (1 – very dissatisfied; 2 – a little satisfied; 3 – satisfied; 4 – very satisfied; 5 – extremely satisfied)[21]. Considering the hypothesis that the use of equipment on the patients' heads could make them uncomfortable, the discomfort of using the Oculus Go® was also assessed using the five-point Likert-type scale (1 – not

disturbed at all; 2 – a little bit disturbed; 3 – disturbed; 4 – very disturbed; 5 – extremely disturbed).

Data Analysis and Treatment

Data were tabulated in an Excel spreadsheet and analyzed using SPSS version 24 software. For qualitative variables, absolute and relative frequencies were calculated. Quantitative variables were summarized using statistics: mean, standard deviation, quartiles, minimum and maximum. The comparison of data obtained with and without the use of VR was performed using the Chi-square and McNemar tests for qualitative variables and Wilcoxon for quantitative ones. For all inferential procedures, a significance level of 5% was adopted.

Ethical Aspects

The research was approved by the Research Ethics Committee of the Universidade da Integração Internacional da Lusofonia Afro-Brasileira, under opinion nº 2.649.144/2019, and followed the recommendations of Resolution nº 466/12, of the National Health Council, and all participants signed the Free Informed Consent Form.

RESULTS

There was a predominance of male participants (15/88.2%), retired (11/64.7%), self-declared brown (10/58.8%), and with some primary education (10/58.8%). It was observed, respectively, that 58.8% (n = 10) and 70.6% (n = 13) of the participants had a diagnosis of diabetes mellitus and systemic arterial hypertension. Alcoholism and smoking were not frequent habits.

Regarding the assessment of the wound, there was a predominance of participants with neuropathic ulcers due to diabetes (5/29.4%) and venous ulcers (5/29.4%), with the presence of liquefactive necrosis (9/52.9%). The predominant skin type was skin with edema (8/47.1%) and moist (7/41.2%) skin. Non-cyclic acute pain (during debridement) was predominant (10/58.8%).

In the clinical evaluation, there was identification of participants with hyperkeratosis (11/64.7%), lipodermatosclerosis (10/58.8%), claudication (8/47.1%), and calluses (07/41.2%). The edge of the lesion had erythema and heat in 41.2% (n = 10). The most used topical treatment was silver hydrofiber (6/35.3%) and calcium alginate (4/23.5%).

In the assessment of vital signs and pain scores before starting the dressing, there was a significant difference when comparing the groups in relation to heart rate (p = 0.044), as shown in Table 1.

The data in Table 2 show that the behavioral assessment during dressing changes showed significant differences in typical facial expression of pain (p = 0.016) and protective posture (p = 0.031) in the group comparison. The table also shows that the physiological aspects of facial expression typical of pain, altered body movement, protective posture, sweating and paleness did not show any statistical difference between the groups. Participants who used VR during dressing change had less pain when compared to the group without VR (Table 2).

The analysis of heart rate after dressing change revealed a statistically significant difference (p = 0.001) between the groups with and without VR (Table 3). There were also significant differences between the two groups in terms of systolic blood pressure (p = 0.012) and diastolic blood pressure

Table 1 – Vital signs and pain before dressing change, according to the VR and non-VR groups – Redenção, CE, Brazil, 2020.

Variables	no VR	with VR	p value†
	Median (1st–3rd quartiles)		
Heart rate	89 (84–92)	82 (76–89)	**0.044**
Systolic blood pressure	136 (124–148)	140 (128–142)	0.203
Diastolic blood pressure	90 (84–92)	90 (86–92)	0.102
Temperature	37 (36–37)	37 (36–37)	1.000
Oximetry	98 (97–99)	98 (97–99)	0.180
Pain intensity	6 (4–7)	5 (4–7)	0.088
Worst pain in the last 24 hours	7 (6–9)	7 (6–8)	1.000
Mildest pain in the last 24 hours	5 (3–7)	4 (3–7)	1.000

†Wilcoxon Test.

Table 2 – Behavioral, physiological, and pain aspects during dressing change, according to the VR and non-VR groups – Redenção, CE, Brazil, 2020.

Variables	no VR	with VR	p value†
	n (%)	n (%)	
Typical facial expression of pain	9 (52.9)	2 (11.8)	**0.016**
Altered body movement	10 (58.8)	3 (17.6)	0.065
Protective posture	7 (41.2)	1 (5.9)	**0.031**
Sweating	3 (17.6)	2 (11.8)	1.000
Pallor	1 (5.9)	0 (0)	–
Pain intensity	8 (6–9.5)	1 (0–2.5)	**<0.001**

†McNemar Test.

Table 3 – Vital signs and pain after dressing change, according to the VR and non-VR groups – Redenção, CE, Brazil, 2020.

Variables	no VR	with VR	p value†
	Median (1st–3rd quartiles)		
Heart rate	89 (85–92)	80 (76–82)	**0.001**
Systolic blood pressure	136 (128–148)	130 (124–140)	**0.012**
Diastolic blood pressure	90 (88–92)	88 (80–90)	**0.004**
Temperature	37 (36–37)	36 (36–37)	0.083
Oximetry	98 (97–99)	98 (97–99)	0.317
Pain intensity	05 (5–8)	01 (0–2)	**<0.001**

†Wilcoxon Test.

Table 4 – Satisfaction and discomfort of using virtual reality – Redenção, CE, Brazil, 2020.

Variables	n (%)
Satisfaction	
Extremely satisfied	11 (64.7)
Very satisfied	6 (35.3)
Discomfort	
Absent	16 (94.1)
A little bit	1 (5.8)

(p = 0.004) values after dressing application completion. The group that used VR had less pain after dressing, with a significant difference.

The data in Table 4 show that most participants were quite satisfied with Oculus Go® during dressing change (64.7%). Furthermore, 94.1% did not feel any discomfort in using the intervention.

DISCUSSION

The present study showed that participants who used VR had less pain during and after dressing change. Studies consulted corroborate this finding[12,22]. Dutch researchers identified that the intensity of pain during dressing replacement in children and adults was statistically lower with the use of VR[23]. Another study[15] with a similar scope demonstrated that immersive VR was effective as a pain distraction tool during dressing change.

The reduction in pain during dressing changes is due to the user's attention shift away from the painful sensations, due to the visual and auditory distraction promoted by VR. Two primary functions of VR are distraction and the creation of a sense of presence in a simulated location. Distraction entertains the user away from the situation of real world, such as pain-inducing procedures, and the sensation of presence in a simulated place allows the user to "experience" a projected scenario that simulates removing him/her from the treatment environment[24].

Thus, VR is exclusively characterized as immersive and involving, integrating many sensory experiences thus capturing a greater degree of attention from the person using it, reducing the perception of pain, and can then be used as a useful complement to non-pharmacological analgesia in dressing replacement[15,25,26].

This data infers the relevance of using VR before starting the procedure until its completion, leaving the patient more relaxed and calm during cleaning, debridement and replacement of the coverings of their injury, especially in chronic wounds, which are often painful, and need periodic dressing change.

A study in China[15] showed that the pain relief effect of VR was more significant during the dressing change procedure compared to before or after the dressing change, corroborating the findings presented.

Participants who received VR glasses had lower heart rates and lower systolic and diastolic blood pressures before and after dressing change. Previous studies[8,27] have shown a significant reduction in heart rate in participants who used VR compared to the control group. The reduction in systolic and diastolic blood pressure may be related to the fact that offering VR before starting the dressing helps to reduce anxiety and the fear of pain, through distraction, which minimizes the time for thoughts of pain that one may feel when the procedure is started, leaving patients more relaxed[16,28].

It was noticed that the participants who used VR had lower facial expression typical of pain and protective posture during dressing change, making them more collaborative with the procedure for removing the dressing and cleaning the lesion. The use of VR can improve the painful change of dressings and improve patient cooperation during the procedure, with less exhaustion from health professionals and less time spent on each dressing, as the patient becomes calmer and more collaborative[16]. In addition, VR can reduce drug dependence in this public and minimize health care costs.

After finishing the dressing application, besides pain reduction, systolic and diastolic blood pressures were also significantly lower in the group using VR. A study consulted suggests a connection between acute or chronic pain and cardiovascular alterations, which can interfere with heart rate and stroke volume[29]. The study results corroborate the positive effect of VR on the clinical data of patients during dressing change for chronic wounds, contributing to the success of the procedure.

These findings emphasize the importance of health professionals who deal with wound care using this technology, as people with chronic wounds may experience persistent and debilitating pain that cannot be adequately treated with common analgesics and that negatively affects the timing of dressings change[30]. It should be noted that dressing change is an essential part of wound treatment, as it contributes to the maintenance of a clean environment, free of pathogens and with physiological humidity.

The use of the Oculus Go® for auditory and visual immersion during dressing change did not cause discomfort to the participants and most of them were satisfied during this study. A study showed greater satisfaction, by users who had reduced pain, with the use of VR than when watching television[11]. Participants satisfaction when using Oculus Go® can contribute to improving the quality of care, due to its practicality in placement and removal, without causing adverse effects during use, being, therefore, well accepted by users[11,16]. Recent research has shown that the use of VR did not lead to adverse events in participants[11].

This study participants' characteristics may limit the generalization of the results to other populations, as they were collected in a specific geographic region. Moreover, the effects of VR in a single dressing change were evaluated. Despite these limitations, the present study makes important contributions to the state of the art, and the results may have important implications for the care of people with chronic wounds. Future research with other more robust studies,

with larger samples, follow-up, and several dressing changes are needed to determine if the current results are replicated.

CONCLUSION

The use of VR showed positive effects in pain relief during chronic wound dressing change. VR provided the distraction from pain perception during dressing replacement, with significant differences in heart rate, systolic and diastolic blood pressure before and after dressing change, reflecting better behavioral and physiological aspects during dressing change. Virtual reality did not cause any discomfort and participants were satisfied with its use.

RESUMO

Objetivo: Avaliar o efeito da realidade virtual no alívio da dor durante a troca de curativos de feridas crônicas. **Método:** Estudo experimental realizado com 17 participantes, em ambulatório de estomaterapia no Ceará, Brasil, de junho a dezembro de 2019, com utilização de óculos de realidade virtual *Oculus Go*®. Coletaram-se informações sociodemográficas, clínicas, de hábitos de vida e sobre as características das lesões. Utilizou-se escala de faces e visual analógica para avaliação da dor, avaliação de aspectos comportamentais, satisfação e incômodo do *Oculus Go*®. Utilizaram-se os testes Qui-quadrado, McNemar e Wilcoxon. O estudo foi aprovado sob parecer de nº 2.649.144/2019. **Resultados:** Houve redução da dor na troca de curativo com *Oculus Go*®. Os participantes com *Oculus Go*® manifestaram menos dor durante ($p < 0,001$) e após ($p < 0,001$) a troca de curativos; e apresentaram menor frequência cardíaca antes ($p = 0,044$) e após ($p = 0,001$) o procedimento. Houve diferenças significativas entre os grupos nos valores da pressão arterial sistólica ($p = 0,012$) e diastólica ($p = 0,004$) após o curativo. A realidade virtual não causou incômodo e os participantes mostraram-se satisfeitos. **Conclusão:** A realidade virtual apresentou efeitos positivos no alívio da dor durante a troca de curativos de feridas crônicas.

DESCRITORES

Realidade Virtual; Imageamento Tridimensional; Dor; Ferimentos e Lesões; Satisfação do Paciente.

RESUMEN

Objetivo: Evaluar el efecto de la realidad virtual en el alivio del dolor durante el cambio de vendajes de heridas crónicas. **Método:** Estudio experimental realizado con 17 participantes, en ambulatorio de estomaterapia en Ceará, Brasil, de junio a diciembre de 2019, con utilización de gafas de realidad virtual *Oculus Go*®. Fue posible reunir informaciones sociodemográficas, clínicas, hábitos de vida y características de las lesiones. Fueron utilizadas la escala de faces y la visual analógica para evaluar el dolor, se realizó una evaluación de aspectos comportamentales, de satisfacción e incómodo del *Oculus Go*®. Fueron utilizados los testes Chi-cuadrado, McNemar y Wilcoxon. El estudio fue aprobado bajo la licencia de nº 2.649.144/2019. **Resultados:** Hubo reducción del dolor en el cambio de vendaje con *Oculus Go*®. Los participantes con *Oculus Go*® manifestaron menos dolor durante ($p < 0,001$) y después ($p < 0,001$) del cambio de vendajes; y presentaron menor frecuencia cardíaca antes ($p = 0,044$) y después ($p = 0,001$) del procedimiento. Hubo diferencias significativas entre los grupos en los valores de la tensión arterial sistólica ($p = 0,012$) y diastólica ($p=0,004$) después del vendaje. La realidad virtual no generó incómodo y los participantes demostraron satisfacción. **Conclusión:** La realidad virtual presentó efectos positivos en el alivio del dolor durante el cambio de vendajes de heridas crónicas.

DESCRIPTORES

Realidad Virtual; Imagenología Tridimensional; Dolor; Heridas y Lesiones; Satisfacción del Paciente.

REFERENCES

1. Haalboom M. Chronic Wounds: Innovations in Diagnostics and Therapeutics. Curr Med Chem. 2018;25(41):5772-81. DOI: http://dx.doi.org/10.2174/0929867324666170710120556.
2. Frykberg RG, Banks J. Challenges in the Treatment of Chronic Wounds. Adv Wound Care (New Rochelle). 2015;4(9):560-82. DOI: http://dx.doi.org/10.1089/wound.2015.0635.
3. Park SH, Ferreira KASL, Santos VLCG. Understanding pain and quality of life for patients with chronic venous ulcers. Wounds [Internet]. 2008 [cited 2021 May 14];20(1):309-11. Available from: http://europepmc.org/article/med/25941830.
4. Borges EL, Nascimento Filho HM, Pires Júnior JF. Prevalência de lesões crônicas de município da zona da mata mineira (Brasil). Rev Min Enferm. 2018;22:e-1143. DOI: http://dx.doi.org/10.5935/1415-2762.20180074.
5. Heyer K, Herberger K, Protz K, Glaeske G, Augustin M. Epidemiology of chronic wounds in Germany: Analysis of statutory health insurance data. Wound Repair Regen. 2016;24(2):434-42. DOI: http://dx.doi.org/10.1111/wrr.12387.
6. Salvetti MG, Costa IK, Dantas DV, Freitas CC, Vasconcelos QL, Torres GV. Prevalence of pain and associated factors in venous ulcer patients. Rev Dor. 2014;15(1):17-20. DOI: https://doi.org/10.5935/1806-0013.20140005.
7. Woo KY, Sibbald RG. Chronic wound pain: a conceptual model. Adv Skin Wound Care. 2008;21(4):175-88. DOI: http://dx.doi.org/10.1097/01.ASW.0000305430.01413.2e.
8. Hua Y, Qiu R, Yao WY, Zhang Q, Chen XL. The Effect of Virtual Reality Distraction on Pain Relief During Dressing Changes in Children with Chronic Wounds on Lower Limbs. Pain Manag Nurs. 2015;16(5):685-91. DOI: https://doi.org/10.1016/j.pmn.2015.03.001.
9. Gardner SE, Abbott LI, Fiala CA, Rakel BA. Factors associated with high pain intensity during wound care procedures: A model. Wound Repair Regen. 2017;25(4):558-63. DOI: https://doi.org/10.1111/wrr.12553.
10. Oliveira PFT, Tatagiba BSF, Martins MA, Tripple AFV, Pereira LV. Assessment of pain during leg ulcers' dressing change. Text Context Nursing. 2012;21(4):862-9. DOI: https://doi.org/10.1590/S0104-07072012000400017.
11. Spiegel B, Fuller G, Lopez M, Dupuy T, Noah B, Howard A, et al. Virtual reality for management of pain in hospitalized patients: A randomized comparative effectiveness trial. PLoS One. 2019;14(8):e0219115. DOI: https://doi.org/10.1371/journal.pone.0219115.
12. Freitas DM, Spadoni VS. A realidade virtual é útil para manejo da dor em pacientes submetidos a procedimentos médicos? Einstein (São Paulo). 2019;17(2):1-3. DOI: https://doi.org/10.31744/einstein_journal/2019MD4837.

13. Lier EJ, Oosterman JM, Assmann R, Vries M, Van Goor H. The effect of Virtual Reality on evoked potentials following painful electrical stimuli and subjective pain. Sci Rep. 2020;10(1):1-10. DOI: https://doi.org/10.1038/s41598-020-66035-4.

14. Kucyi A, Davis KD. The dynamic pain connectome. Trends Neurosci. 2015;38(2):86-95. DOI: https://doi.org/10.1016/j.tins.2014.11.006.

15. Ding J, He Y, Chen L, Zhu B, Cai Q, Chen K, et al. Virtual reality distraction decreases pain during daily dressing changes following haemorrhoid surgery. J Int Med Res. 2019;47(9):4380-88. DOI: https://doi.org/10.1177/0300060519857862.

16. Scapin SQ, Echevarría-Guanilo ME, Fuculo Junior PRB, Martins JC, Barbosa MV, Pereima MJL. Use of virtual reality for treating burned children: case reports. Rev Bras Enferm. 2017;70(6):1291-5. DOI: http://dx.doi.org/10.1590/0034-7167-2016-0575.

17. Markova A, Mostow EN. US skin disease assessment: ulcer and wound care. Dermatol Clin. 2012;30(1):107-11. DOI: http://dx.doi.org/10.1016/j.det.2011.08.005.

18. Calais LL, Russo ICP, Borges ACLC. Desempenho de idosos em um teste de fala na presença de ruído. Pró-Fono Revista de Atualização Científica [Internet]. 2008 [cited 2021 Mar 22];20(3):147-52. Available from: https://www.scielo.br/pdf/pfono/v20n3/02.pdf.

19. Pereira LV, Sousa FAEF. Mensuração e avaliação da dor pós-operatória: uma breve revisão. Rev Latino Am Enfermagem [Internet]. 1998 [cited 2021 May 14];6(3):77-84. Available from: https://www.scielo.br/pdf/rlae/v6n3/13894.pdf.

20. Martinez JE, Grassi DC, Marques LG. Análise da aplicabilidade de três instrumentos de avaliação de dor em distintas unidades de atendimento: ambulatório, enfermaria e urgência. Rev Bras Reumatol [Internet]. 2011 [cited 2021 May 14];51(4):299-308. Available from: https://www.scielo.br/pdf/rbr/v51n4/v51n4a02.pdf.

21. Souza MC, Biazini PLA, Furuta DT, Moliterno AH, Uliam NR, Oliveira DF, et al. A influência da realidade virtual sobre a velocidade da marcha e avaliação da satisfação de indivíduos com doença de Parkinson. Colloq Vitae. 2020;12(3):1-9. DOI: https://doi.org/10.5747/cv.2020.v12.n3.v304.

22. Furness PJ, Phelan I, Babiker NT, Fehily O, Lindley SA, Thompson AR. Reducing Pain During Wound Dressings in Burn Care Using Virtual Reality: A Study of Perceived Impact and Usability With Patients and Nurses. J Burn Care Res. 2019;40(6):878-85. DOI: https://doi.org/10.1093/jbcr/irz106.

23. Faber AW, Patterson DR, Bremer M. Repeated use of immersive virtual reality therapy to control pain during wound dressing changes in pediatric and adult burn patients. J Burn Care Res. 2013;34(5):563-8. DOI: https://doi.org/10.1097/BCR.0b013e3182777904.

24. Yeung AWK, Tosevska A, Klager E, Eibensteiner F, Laxar D, Stoyanov J, et al. Virtual and Augmented Reality Applications in Medicine: Analysis of the Scientific Literature. J Med Internet Res. 2021;23(2):e25499. DOI: https://doi.org/10.2196/25499.

25. Esumi R, Yokochi A, Shimaoka M, Kawamoto E. Virtual reality as a non-pharmacologic analgesic for fasciotomy wound infections in acute compartment syndrome: a case report. J Med Case Rep. 2020;14(1):1-7. DOI: https://doi.org/10.1186/s13256-020-02370-4.

26. Ahmadpour N, Randall H, Choksi H, Gao A, Vaughan C, Poronnik P. Virtual Reality interventions for acute and chronic pain management. Int J Biochem Cell Biol. 2019;114(105568):1-4. DOI: https://doi.org/10.1016/j.biocel.2019.105568.

27. Gershon J, Zimand E, Pickering M, Rothbaum BO, Hodges L. A pilot and feasibility study of virtual reality as a distraction for children with cancer. J Am Acad Child Adolesc Psychiatry 2004;43(10):1243-9. DOI: https://doi.org/10.1097/01.chi.0000135621.23145.05.

28. Sahin G, Basak T. The Effects of Intraoperative Progressive Muscle Relaxation and Virtual Reality Application on Anxiety, Vital Signs, and Satisfaction: A Randomized Controlled Trial. J Perianesth Nurs. 2020;35(3):269-76. DOI: https://doi.org/10.1016/j.jopan.2019.11.002.

29. Chiang HL, Huang YC, Lin HS, Chan MH, Chia YY. Hypertension and Postoperative Pain: A Prospective Observational Study. Pain Res Manag. 2019;(8946195):1-6. DOI: https://doi.org/10.1155/2019/8946195.

30. Acevedo P. Successful treatment of painful chronic wounds with amniotic and umbilical cord tissue: A case series. SAGE Open Med Case Rep. 2020;8(1):1-6. DOI: https://doi.org/10.1177/2050313X20910599.