Revista ARACÊ
ISSN: 2358-2472

GAMETHERAPY EFFECTS ON PATIENT REHABILITATION AT A BURNS INTENSIVE CARE UNIT: A PILOT STUDY

https://doi.org/10.56238/arev7n10-164

Date of submission: 09/15/2025 **Date of publication:** 10/15/2025

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ABSTRACT

Objectives: Assess the effect of game therapy on functional rehabilitation of burned patients within a Burns Intensive Care Unit.

Design: controlled and randomized pilot study. Twenty-nine patients with upper limbs and thoracic burns. Ten sessions were performed in both groups, lasting 30 min. Test group (Gwii n = 15) was rehabilitated through of tennis, golf and boxing, while control group (GPt n = 14) were assigned activities that addressed the same goals of game therapy. Main outcome measure: palmar grip strength test, maximal respiratory pressures, six-minute walking test, functional independence level, anxiety and pain determined by Burns Specific Pain Anxiety Scale. Randomization: Patients were distributed into two intervention groups: Group Nintendo Wii Sport (n = 10) and Group Conventional Physical Therapy (n = 10), through a random and independent draw. Statistical analysis: The comparative analyses between intra- and inter-group physiotherapy protocols were paired tests of Student or Wilcoxon.

Results: A significant increase in MEP (p = 0.0226), right upper limb dynamometry (p = 0.0203), left upper limb dynamometry (p = 0.0367), FIL (p = 0.0003) and 6MWT (p = 0.0019), as well as a significant reduction of anxiety and pain level (p = 0.0323), yet in GPt group all variables studied had a significant improvement. However, in the evaluations between the groups (inter-group), there was no significant difference in any variable studied.

Conclusion: Game Therapy may be a resource with therapeutic potential in the functional recovery of the burned patients, since, in this study, it obtained results similar to conventional physiotherapy

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ISSN: 2358-2472

Keywords: Virtual Reality. Rehab. Burned. Nintendo Wii.

EFEITOS DA GAMETERAPIA NA REABILITAÇÃO DE PACIENTES EM UNIDADE DE TERAPIA INTENSIVA DE QUEIMADOS: UM ESTUDO PILOTO

RESUMO
Objetivos: Avaliar o efeito da gameterapia na reabilitação funcional de pacientes queimados em uma Unidade de Terapia Intensiva de Queimados.

Delineamento: estudo piloto controlado e randomizado. Vinte e nove pacientes com queimaduras de membros superiores e torácicas. Dez sessões foram realizadas em ambos os grupos, com duração de 30 minutos. O grupo teste (Gwii n = 15) foi reabilitado por meio de tênis, golfe e boxe, enquanto o grupo controle (GPt n = 14) recebeu atividades que abordavam os mesmos objetivos da gameterapia. Principais desfechos: teste de força de preensão palmar, pressões respiratórias máximas, teste de caminhada de seis minutos, nível de independência funcional, ansiedade e dor determinados pela Escala de Ansiedade e Dor Específica para Queimados. Randomização: Os pacientes foram distribuídos em dois grupos de intervenção: Grupo Nintendo Wii Sport (n = 10) e Grupo Fisioterapia Convencional (n = 10), por meio de sorteio aleatório e independente. Análise estatística: As análises comparativas entre os protocolos de fisioterapia intra e intergrupos foram testes pareados de Student ou Wilcoxon.

Resultados: Houve aumento significativo na PEmáx (p = 0,0226), dinamometria de membro superior direito (p = 0,0203), dinamometria de membro superior esquerdo (p = 0,0367), FIL (p = 0,0003) e TC6 (p = 0,0019), bem como redução significativa da ansiedade e do nível de dor (p = 0,0323), porém no grupo GPt todas as variáveis estudadas apresentaram melhora significativa. Entretanto, nas avaliações entre os grupos (intergrupo), não houve diferença significativa em nenhuma variável estudada.

Conclusão: A Gameterapia pode ser um recurso com potencial terapêutico na recuperação funcional de pacientes queimados, visto que, neste estudo, obteve resultados semelhantes à fisioterapia convencional.

Palavras-chave: Realidade Virtual. Reabilitação. Queimado. Nintendo Wii.

EFECTOS DE LA GAMETERAPIA EN LA REHABILITACIÓN DE PACIENTES EN UNA UNIDAD DE CUIDADOS INTENSIVOS DE QUEMADOS: UN ESTUDIO PILOTO

RESUMEN
Objetivos: Evaluar el efecto de la ludoterapia en la rehabilitación funcional de pacientes con quemaduras en una Unidad de Cuidados Intensivos de Quemados.

Diseño: Estudio piloto controlado y aleatorizado. Veintinueve pacientes con quemaduras en miembros superiores y tórax. Se realizaron diez sesiones en ambos grupos, con una duración de 30 minutos. El grupo de prueba (Gwii n = 15) se rehabilitó mediante tenis, golf y boxeo, mientras que el grupo control (GPt n = 14) realizó actividades que abordaban los mismos objetivos de la ludoterapia. Medida principal de resultados: prueba de fuerza de

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ISSN: 2358-2472

prensión palmar, presiones respiratorias máximas, prueba de marcha de seis minutos, nivel de independencia funcional, ansiedad y dolor determinados mediante la Escala de Ansiedad por Dolor Específico de Quemaduras. Aleatorización: Los pacientes se distribuyeron en dos grupos de intervención: Grupo Nintendo Wii Sport (n = 10) y Grupo Fisioterapia Convencional (n = 10), mediante un sorteo aleatorio e independiente. Análisis estadístico: Los análisis comparativos entre los protocolos de fisioterapia intra e intergrupales se realizaron mediante pruebas pareadas de Student o Wilcoxon.

Resultados: Se observó un aumento significativo en la PME (p = 0,0226), la dinamometría de la extremidad superior derecha (p = 0,0203), la dinamometría de la extremidad superior izquierda (p = 0,0367), el FIL (p = 0,0003) y la prueba de 6 minutos (p = 0,0019), así como una reducción significativa de la ansiedad y el dolor (p = 0,0323). Sin embargo, en el grupo de terapia de juego, todas las variables estudiadas mostraron una mejora significativa. Sin embargo, en las evaluaciones intergrupales, no se observaron diferencias significativas en ninguna de las variables estudiadas.

Conclusión: La terapia de juego puede ser un recurso con potencial terapéutico en la recuperación funcional de los pacientes con quemaduras, ya que, en este estudio, se obtuvieron resultados similares a los de la fisioterapia convencional.

Palabras clave: Realidad Virtual. Rehabilitación. Quemados. Nintendo Wii.

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ISSN: 2358-2472

1 INTRODUCTION

Dermal burns are considered the most devastating trauma affecting people. It generates numerous body changes and usually leaves physical, emotional and psychological sequelae. In Brazil there are one million burns victims per year, of this total, 1,144 perish [1]. However, over the last two decades, mortality rates of patients with large burns have decreased, due to improvements in treatment and post-injury care, emphasizing, also, the importance of rehabilitation to maximize physical recovery [2].

Physiotherapeutic treatment in burns patients aims to prevent respiratory complications, contractures and deformities. Also, minimizes loss of muscle mass and reduces pain caused by immobility through cardiorespiratory fitness exercises, functional training, stretching and play activities [3,4]. However, frequently a patient in hospital environment is reluctant to participate fully in treatment, due to the difficulty in dealing with the pain and anxiety generated by the own activity intended to help his recovery [5].

The search for new therapeutic modalities that provide better adherence of burns patients to rehabilitation treatment becomes extremely relevant to science and clinical practice. Virtual reality (VR), for instance, is a technic that uses motion detecting software's and technologies, through games, creating tridimensional worlds, being able to adapt them to different needs of therapeutic interventions.

Interactive video-games commercially available, such as Nintendo Wii™, PlayStation 3, Xbox Kinect™ and Moove™ have been used in rehabilitation of cardiac [6,7], cerebral palsy [8,9], with sequels of cerebrovascular accident (CVA) [10] and Parkinson's disease patients [8]. However, few scientific studies assessed the effect of interactive games on therapeutic rehabilitation of burns patients in an intensive care unit.

Thus, the objective of this study was to assess the effect of Nintendo Wii in burns patients through a pilot study at a Burns Intensive Care Unit (BICU), through instruments that evaluate maximal respiratory pressures, palmar grip strength, functionality, cardiorespiratory fitness and anxiety/pain.

2 METHODS

2.1 STUDY DESIGN

This is a pilot prospective study, quantitative, controlled, randomized and blind, with a non probability or convenience sample.

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2.2 PARTICIPANTS

Participants were recruited in a Burns Intensive Care Unit (BICU) from Hospital de Urgências de Sergipe (HUSE), located in Aracaju, Brazil. Were included victims aged above 12 years, with 2nd and 3rd degree burns in the thoracic and upper limbs area, hemodynamically stable, able for rehabilitation and with cognitive capacity to follow simple commands, with normal or orthoses corrected eyesight and hearing. Were excluded those that presented previous burns sequelae and/or central or peripheral encephalopathies, fractures, muscle sprain, psychiatric disorder, use of artificial airways (endotracheal tubes) and mechanical ventilator support. During initial approach, the objectives and characteristics of the research were clarified to the remaining participants and they signed the Informed Consent Form (ICF). The study was performed according to CONSORT guidelines and was approved by Research Ethics Committee of Universidade Federal de Sergipe (CEP-UFS), under protocol CAAEE: 50511515.8.0000.5546 and Opinion Number: 1.353603.

2.3 PROCEDURE

The first physiotherapeutic evaluation (1stEv.) was performed by evaluator 1 and, then, evaluator 2 started the process of randomization through random and independent drawing, for distribution over two intervention groups: Group treated with Nintendo Wii Sport (Gwii) (n=10) and Group treated with Conventional Physical Therapy (GPt) (n=10).

Were performed 10 intervention sessions in both groups, lasting 40 min, for 5 days a week. Before intervention, patients received 10 minutes of passive stretching, sustained for 30 seconds in one repetition, on the muscles of neck (flexors, extensors and rotators), shoulder (adductors, abductors and flexors) and fists (flexors and extensors). The stretching was performed with patient seated on a chair, with hips, knees and ankles joints at 90°, feet flat on the floor.

2.4 NINTENDO WII

Patients of GWii were rehabilitated with Nintendo Wii Sport in 3 sports modalities (tennis, golf and boxing) with a duration of 10 min each, making a total of 30 minutes. During the first contact, they received instructions over the operation of the console and sports games. To start the intervention, they remained seated, according to stretching posture, distant 1 meter from the device and with image projected in a television. In the modalities tennis and golf, the control (Wii Remote) switched hands every 5 minutes, over the execution,

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ISSN: 2358-2472

promoting mobilization in both upper limbs. In boxing, this switch wasn't necessary, because initial movements of upper limbs already were alternated during the whole activity.

It wasn't possible to count the number of repeated movements, being stablished a time limit of 10 minutes for each sports modality. Every time a new game was set, a break of 2 minutes allowed the patient to rest. The patient's performance over the activities was followed by the physiotherapist responsible for the research. Words of motivation, like "Let's go!", "Very Good!", "Keep going!", "Spread your arms!", "Power!" were said every one minute.

2.5 CONVENTIONAL PHYSICAL THERAPY

Rehabilitation in GPt was projected with activities that contained the same objectives of gametherapy, also with a 30 minutes duration. Patients were positioned seated in a chair in upright posture, with hips, knees and ankles at 90°, feet flat on the floor. They performed active exercises in sequence: 1) Upper limbs performed diagonal active movements, initially in abduction and external shoulder rotation, elbow semi-flexed and clenched fist; 2) Upper limbs performed elbow flexo-extension associated to 90° horizontal abduction of shoulder and finalized the movement with one of the hands in contact with the counter lateral shoulder, elbow flexed and fists in pronation; 3) Trunk rotation performed with shoulders at 90°, elbow extension and fists together to perform the movement; 4) Alternated anterior elevation of upper limbs from neutral position to 90° of shoulder flexion and returning to starting position; 5) Scapular girdle dissociation associated to alternated movements of upper limbs, performed, initially, with scapular abduction, shoulder flexed at 90°, elbow extended, clenched fists in pronation, followed by the return of the movement with scapular adduction, shoulder flexion and fists clenched in neutral position.

All these movements were performed in 3 series of 12 repetitions, with rest interval of 2 minutes between series. The physiotherapist positioned herself in front of the patient, to incentive and motivate in the active movement of arms without applied resistance. Were used the same words of motivation in both groups.

Besides, patients of both groups received orientation to perform the requested movements effectively and productively, having an individual perception of muscle contraction of upper limbs, chest and abdominal muscles. They were stimulated to perform abdominal contraction associated to forced expiration during the execution concentric contraction of movements. Still were stimulated to perform the movements in their maximal limit of amplitude, associated to deep breath, to optimize thoracic expandability and minimize

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ISSN: 2358-2472

contention by compressive bandage and tissue retraction generated by the wound healing itself.

2.6 MEASURES OF FUNCTIONAL KINESIOLOGICAL EVALUATION

Patients were evaluated in two moments: on admission (1st evaluation) and after the 10th session (2nd evaluation), by a trained evaluator (Evaluator 1), guaranteeing accuracy in performance measurement of participants.

Initially, were verified vital signs, such as partial oxygen saturation (SatO2) and heart rate (HR), using a finger oximeter, model MF-426 and brand More Fitness, arterial pressure (AP) was measured by the Aneróide Premium sphygmomanometer and respiratory rate was quantified by observing respiratory cycle for 60 seconds, counted by a simple black chronometer from brand Herweng.

Next, were quantified the variables off palmar prehension strength, maximal respiratory pressures, functional independence level, anxiety/pain and walking test of 6 minutes, respectively.

Muscle strength was measured using a Smedley hand dynamometer, from brand Saehan. The researcher would give the verbal command to perform maximal palmar prehension strength sustained for three seconds. First we tested the right hand and then the left hand, carefully following the equipment instrumentation. Were performed three alternate measures in each hand, with a break of 60 seconds between them, writing the mean of the respective measures.

To measure maximal inspiratory pressure (IPmax) and maximal expiratory pressure (EPmax), was used an analog manovacuometer from Wika®. The patient maintained the initial seated posture and measurement of maximal pressures was according to American Thoracic Society (ATS) guidelines [11].

The Functional Independence Level (FIL) was performed to assess, quantitatively, the individual's capacity of developing daily care tasks. FIL is composed by 18 items, arranged in two fields: motor and cognitive.12 For each item, is attributed a grade from 01 (total dependence) to 07 (complete independence), totaling 180 points, meaning that, the higher the score, higher the independence level obtained.

To evaluate anxiety and pain levels, was used the scale Burns Specific Pain Anxiety Scale (BSPAS).13 This is a specific tool, composed by nine questions, aiming to assess anticipatory anxiety in burns patients. Those questions were answered by the evaluated

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through a visual analog scale of two points each, ranging from 0 (negative answer in every item) to 10 (worst pain imaginable), totaling a score of 90 points. The higher the score, the higher the anxiety level expressed in relation to painful procedures during patient hospitalization.

Then, patients able to walk, with or without aid, were subjected to 6 minute walking test (6MWT). According to guidelines of American Thoracic Society (ATS),14 6MWT should be performed indoors, along a long, flat, straight, enclosed corridor with a hard surface that is seldom traveled, with a length of 30 meters. But this study performed the test in a 20 meters corridor, once that Rostagno et al.15 and Aquino et al.16 reported that 6MWT in 20 m is reproducible and viable. The extremities of the course were delimited by yellow cones and the floor was marked with yellow tape every meter, to facilitate measuring. During the walk, the patient was encouraged every one minute with words of motivation, standardized and adapted by ATS, being monitored as to heart rate, perceived exertion, using Borg scale, and oxygen saturation (SpO2) with an oximeter, every 2 minutes.

All these data were recorded in an evaluation form made by the researchers, specifically for this purpose.

2.7 STATISTICAL ANALYSIS

Statistical analysis was performed descriptively and analytically. First, the data were tabulated and determined means and percentages. These results were graphically represented using software Origin 8.0. Comparative analysis among the intra and inter groups physiotherapy protocols were performed after the Shapiro and Wilk test for normality to classify the data as parametric or non-parametric. Then, were used paired tests of Student or Wilcoxon. For such, was used the software Bioestat 5.3, considering a confidence interval of 95% ($p<0.05$).

3 RESULTS

From December of 2015 to April of 2017, 111 patients were admitted at the unit with thoracic and upper limbs burns, however, according to the criteria of inclusion and exclusion, 29 patients were selected and randomized to the groups GPt (14 patients) and GWii (15 patients). Of these, 9 patients were removed from the research, because 5 were discharged after third session (GWii: 3 and GPt: 2), 2 after the fourth (GWii: 1 and GPt: 1), not completing the protocol, and one deceased (GPt) due clinical worsening as a result of the burns, not

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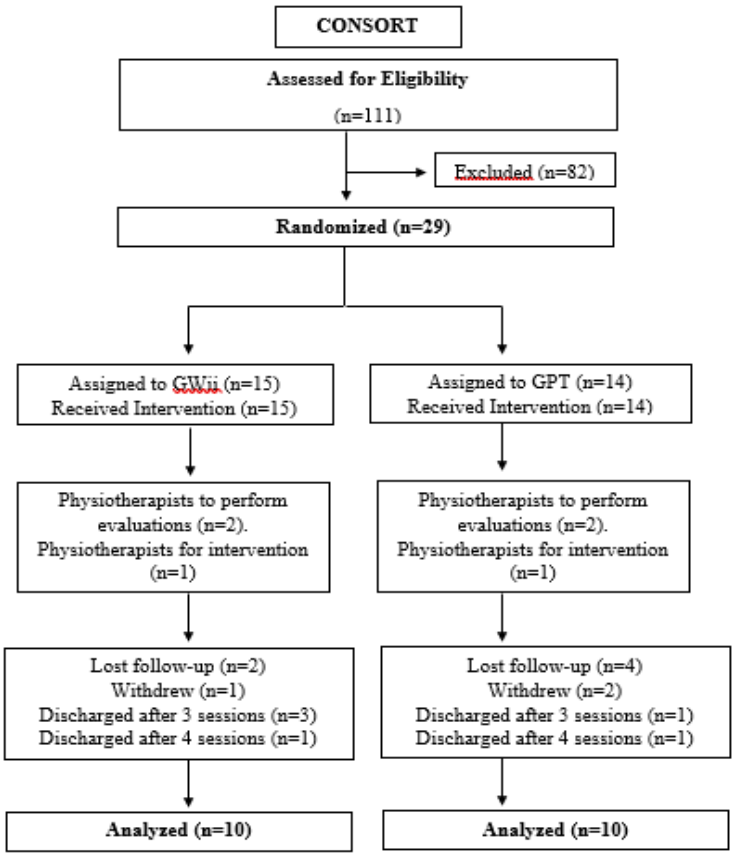
ISSN: 2358-2472

related to the physiotherapeutic intervention. Thus, sample was completed with 20 participants, 10 in each group (Figure 1).

Figure 1

Diagram representing patients flux in the pilot study.



Source: Own authorship (2025)

In this study was not observed significant differences between groups regarding age, BMI and %BBS (Burned Body Surface) (Table 1).

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Table 1

Age, body mass index (BMI) and percentage of burned body surface (BBS) of population studied.

Variable	GPt (n=10)	GWii (n=10)	p
Age (years)	35,7±16,7	28,8±10,1	0,1392
BMI	23,5±5,5	24,0± 4,7	0,4156
%BBS	18,4±10,5	20,4±10,6	0,3391

GPt: Conventional physical therapy group and GWii: *Nintendo wii group*. *Shapiro-Wilk test for normality*, *p<0.05 (T test or Wilcoxon test).
Source: Own authorship (2025)

Table 2 shows the behavior of vital signs along the treatments, aiding in the interpretation of intervention impact on the cardiorespiratory system. Among the collected variables, was verified in the intra group analysis (comparing initial and final data) a significant increase of oxygen saturation (%SatO2), in individuals of both GWii and GPt. Yet, heart rate (HR) presented significant decrease only in GPt and the other variables, respiratory rate (RR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) didn't have significant changes.

Table 2

Gametherapy and Conventional physical therapy effects on vital signs of burns patients in BICU/HUSE.

Variables	GWii			GPt		
	1st Ev.	2nd Ev.	p	1st Ev.	2nd Ev.	p
%$SatO_2$	96,14±2,26	98,42±0,78	0,0216*#	96,30±1,49	99,00±0,66	0,0038*#
HR	103,00±37,53	91,71±29,13	0,0881#	106,75±9,57	94,62±13,10	0,0128*
RR	36,42± 37,41	33,14±34,13	0,1359#	22,25±4,68	18,62±2,38	0,0700
SBP	124,28 ±11,33	121,42±10,69	0,1807#	129,87±15,31	126,25±14,07	0,1869
DBP	80,00 ±5,77	80,00±0,00	0,5000#	77,50±8,86	82,50±8,86	0,1579

GWii: group treated with gametherapy; GPt: group treated with conventional physical therapy; 1st Ev.: first evaluation; 2nd Ev.: second evaluation; %$SatO_2$: percentage of oxygen saturation; HR: heart rate; RF: respiratory rate, SBP: systolic blood pressure and DBP: diastolic blood pressure. *Shapiro-Wilk* test for normality, *p<0.05 (T test or Wilcoxon test).
Source: Own authorship (2025)

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ISSN: 2358-2472

Table 3 shows data from IPmax, EPmax, palmar prehension strength, through dynamometry of left upper limb (DLUL) and right upper limb (DRUL), functional independence level (FIL), walking test of 6 minutes (6MWT) and anxiety and pain score (BSPAS). According to this table, it is possible to observe a significant increase of EPmax, DLUL, DRUL, FIL and 6MWT in GWii intra group evaluation, as well as significant decrease of anxiety and pain levels. In GPt, every variable observed had significant increase.

Table 3

Effects of Gametherapy and Conventional physical therapy on maximal respiratory pressures, manual prehension strength of upper limbs, measure of functional independence, 6 minutes walking test and anxiety and pain scale (Burns Specific Pain Anxiety Scale) in BICU/HUSE burns patients.

Variables	GWii			GPt		
	1st Ev.	2nd Ev.	p	1st Ev.	2nd Ev.	P
Maximal Respiratory Pressures						
IPmax	123,57±33,75	135,71±33,59	0,0794	91,25± 33,13	125,62±36,62	0,0026*
EPmax	60,71±22,44	75,00±18,02	0,0226*	65,62±26,91	81,87±19,98	0,0069*
Dynamometry						
DMRUL (Kgf)	20,00± 13,51	25,28±14,55	0,0203*	23,87± 11,49	27,50±11,26	0,0352*
DMLUL (Kgf)	18,14±12,04	24,57±8,38	0,0367*	15,12±12,25	22,00±11,12	0,0264*
Functional Independence Level						
FIL	79.14±12.61	112.28±11.95	0.0003*	92.50± 21.50	121.37±6.56	0.0059*#
6 Minutes Walking Test						
6MWT	192.80±119.52	341.80±93.83	0.0019*	257.50±142.82	431.00±174.87	0.0005*
Anxiety and pain scale						
BSPAS	58.71±24.12	29.71±26.34	0.0323*	47.25±21.97	24.12±18.71	0.0009*

GWii: group treated with gametherapy; GPt: group treated with conventional physical therapy; 1st Ev.: first evaluation; 2nd Ev.: second evaluation (revaluation after intervention); IPmax and EPmax: Evaluations of inspiratory and expiratory maximal respiratory pressures; DM: manual prehension strength, from dynamometry of right upper limb (DMRUL) and left upper limb (DMLUL); FIL: Functional Independence Level; 6MWT: Walking test of six munutes; BSPAS: *Burns Specific Pain Anxiety Scale* (Scale of anxiety and pain). *Shapiro-Wilk* test for normality, *p<0.05 (T test or Wilcoxon test).
Source: Own authorship (2025)

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Comparing the data obtained from the evaluations between groups (inter group), there was no significant difference in any variable studied, both in initial patient evaluation and final evaluation (Table 4).

Table 4

Effects of Gametherapy and Conventional physical therapy on maximal respiratory pressures, manual prehension strength of both upper limbs, functional independence level, six minutes walking test (6MWT) and anxiety and pain scale (Burns Specific Pain Anxiety Scale) in BICU/HUSE burns patients.

Variables	GWii	GPt		GWii	GPt	
	1st Ev.	1st Ev.	p	2nd Ev.	2nd Ev.	p
Maximal Respiratory Pressures						
IPmax	123,57±33,75	91,25± 33,13	0.1540#	135,71±33,59	125,62±36,62	0.3575#
EPmax	60,71±22,44	65,62±26,91	0.3155	75,00±18,02	81,87±19,98	0,2189
Dynamometry						
DMMD (Kgf)	20,00± 13,51	23,87± 11,49	0.4859	25,28±14,55	27,50±11,26	0.3949
DMME (Kgf)	18,14±12,04	15,12±12,25	0.4551	24,57±8,38	22,00±11,12	0.3001#
Functional Independence Level						
FIL	79,14±12,61	92,50± 21,50	0.1931#	112,28±11.95	121,37±6.56	0.0865#
6 Minutes Walking Test						
6MWT	192,80±119,52	257,50±142,82	0.4212	341,80±93,83	431,00±174,87	0.1722
Anxiety and pain scale						
BSPAS	58,71±24,12	47,25±21,97	0.2431	29,71±26,34	24,12±18,71	0.4672

Gwii: group treated with gametherapy; GPt: group treated with conventional physical therapy; 1st Ev.: first evaluation; 2nd Ev.: second evaluation (revaluation after intervention); IPmax and EPmax: Evaluations of inspiratory and expiratory maximal respiratory pressures; DM: manual prehension strength, from dynamometry of right upper limb (DMRUL) and left upper limb (DMLUL); FIL: Functional Independence Level; 6MWT: Walking test of six minutes); BSPAS: *Burns Specific Pain Anxiety Scale* (Anxiety and pain scale). Shapiro-Wilk test for normality, *p<0.05 (T test or Wilcoxon test).
Source: Own authorship (2025)

4 DISCUSION

The results from this study showed that gametherapy and conventional physical therapy improves oxygenation (SatO2) in patients with thoracic and upper limbs burns. According to Torquato et al., [17] patients with thoracic burns presented restriction of chest expansion due to injury, pain and its occlusive dressing. These changes modify maximal

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ISSN: 2358-2472

respiratory pressures, because of less use respiratory muscles, consequently, decreasing pulmonary volumes and capacities.

Since conventional physical therapy and gametherapy are activities that cause physiological changes, resulting from cardiorespiratory adaptations , [18] was possible to observe significant increase of %SatO2 in both groups.

The purpose of evaluating maximal respiratory pressures (IPmax and EPmax) is based on the principle that these variables suggest muscular deficits, both respiratory and peripheral.[19,20] In a study conducted by Caruso et al.,[21] the analysis of IPmax found neuromuscular disorders acquired by a critical patient during hospitalization. A significant increase of IPmax was observed only in GPt, suggesting that the proposed protocol for GWii didn't generate variable variation during the 10 sessions.

On the other hand, EPmax increased significantly in both groups. Kumar,[22] Ezechieli et al.[23] and Chang et al.[24] pointed that EPmax have direct relation with abdominal muscles strength, signaling cough effectiveness, and, indirectly, diaphragmatic biomechanics condition. It's known that abdominal muscles are essential to maintenance of correct body posture, minimizing overloads and favoring diaphragm eventration in craniocaudal direction.[23]

Besides these findings, we can highlight that both groups showed significant improve of palmar prehension strength, functional predicting and global muscle strength variable.[25,26] According to Mesquita & Gardenghi,27 a burns patient undergo considerable losses of muscle strength, due to immobilism in the bed, functional restrictions and protein catabolism, as confirmd by Wu et al.,[28] who reported that the burn leads to a hypermetabolic response with continuous loss of muscle mass and, consequently, loss of strength in the burned area.

However, Bailey et al.[29] and Choi et al.,[10] assure that the motor physiotherapeutic intervention contributes to physical recovery, cardiorespiratory fitness and improves functionality. It is known that the muscle strength obtained through training comprehends neural and morphological factors. Neural adaptation consists in the first step of this process and includes improving in agonist-antagonist (co-contraction) and agonist-synergist relations and intermuscular and intramuscular coordination. These adaptations continue less bluntly and muscular adaptations, evidenced much later, are characterized by hypertrophy and hyperplasia.[30] Moreover, the exercise decreases oxidative stress and inflammation, by increasing production of anti-inflammatory cytokines.[31]

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If we consider the variables indicating that strength increased throughout the program, maximal respiratory pressures and palmar prehension strength, it's possible to infer that both proposed interventions activated the neural factor, responsible for the majority strength gains in the initial phase of training.[32] In addition, highlighting that the changes generated by neuromuscular adaptation contribute to improve functionality, verified in both intervention groups, through FIL and 6MWT.

Considering that FIL is an instrument that evaluates both cognition and functional independence, the increased interaction and motivational incentive during the protocol execution, possibly, contributed to improve in results. In the past years, many authors, like Riberto et al., 12 Gerrard et al.[33] and Kimura et al., [34] emphasized the potential of this tool, in relation to functional kinesiological evaluation, measuring the impact of the disease and therapeutic response evolution.

Another result that showed the interventions efficiency was the increase in distance traveled by patients in both groups. Tabata et al.[35] reported that, the higher the increase in distance traveled in meters, lesser the probability of patients' readmission. There are scientific evidences that distance traveled is an important predictor of functionality and lower limbs muscle strength, being, also, related to maximal respiratory pressures and cardiorespiratory fitness.[36,37] Thus, in this research, the increase in distance traveled could be related to improve of maximal respiratory pressures, dynamometry and FIL.

A factor that may provide doubt in present research is distance traveled in 6MWT. After all, was performed in 20 meters track, but such distance is evidenced and confirmed by Aquino et al.,[16] Rostagno et al.[15] and Veloso-Guedes et al.,[38] who are emphatic when assure that there is no difference in performing 6MWT in a 30 meters track or in a 20 meters one. Suggesting that 6MWT is reproducible in both measures, existing similar patients' effort when performing the test in both measures.

Every result found deserve spotlight for corroborating the importance of interventions proposed by the study, mainly because these benefits aren't just physical.[39] The set of stimuli used, being tactile, sonorous, visual or playful, aim to promote a wellness feeling in patients, contributing for acquisition of positive self-care and social interaction behaviors.

According to Medeiros et al., [40] burns victims might present psychological and/or emotional disturbances prior to the injury, which can be causal factors of the burns, or due to suicide attempt or for adopting a risky behavior. On the other hand, Davydow et al., [41] Medeiros et al.[42] and Costa et al.[43] reported that there are evidences showing that the trauma

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on its own triggers or aggravates anxiety, depression or social phobia symptoms in burns victims.

Was verified, in this study, significant reduction of anxiety and pain in both groups. Against these results, Morris et al.[44] observed that there was no significant difference in anxiety and pain through BSPAS in burns patients treated with gametherapy associated to pharmacological analgesia, when compared to analgesia alone. Hoffman et al.[45] and Sharar et al.[46] reported that VR was effective on significant decrease of pain in burns patients during physical therapy.

When comparing therapeutic responses obtained in GWii and GPt and not finding significant difference in any analyzed variables, it is possible to assure that, under the conditions proposed here, gametherapy was a tool as effective as conventional physical therapy. Lee et al.[47] affirmed that VR is a promising tool and should be considered when choosing a therapeutical plan, especially for providing motivational experiences inside a hostile environment, which is hospital.

5 CONCLUSION

Despite gametherapy didn't offer precision regarding the amount of series and repetitions of exercises, it got responses similar to a systemized physiotherapy protocol, with a pre-determined number of series and repetitions. Another important aspect of GWii refers to an arouse of competitive sense in patients making part of several sports modalities. Keeping focus on target, winning points when well performed and receiving motivational words were, possibly, factors that contributed for this tool being as effective as conventional physical therapy. It's important to note that patients in GWii group presented more frequency and satisfaction performing the therapeutic conduct than GPT group. However, evaluation of satisfaction with the treatment wasn't performed in this research.

Notwithstanding the difficulties, we recognize the scientific potential of this study, which has showed itself innovating and effective in the improve of therapeutic responses of patients subject to the proposed protocols. From the variables studied, we believe to be contributing to a better comprehension of treatment in burns patients, in the injuries' acute phase and hospitalized in an environment of high complexity, such as BICU. Highlighting the importance of new studies aimed to application and evaluation of gametherapy's effect in a greater number of burns patients, assisted in an intra or extra hospital environment.

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REFERENCES

1. Camuci MB, Martins JT, Cardeli AAM, Robazzi MLC. Caracterização epidemiológica de pacientes adultos internados em uma unidade de terapia intensiva de queimados. Cogitare enferm. 2014;19(1):78-83.

2. Ebid AA, Omar MT, Abd El Baky AM. Effect of 12-week isokinetic training on muscle strength in adult with healed thermal burn. Burns. 2012;38(1):61-68.

3. Ward RS. Physical rehabilitation. St. Louis, MO: Mosby; 1998.

4. Borges F. Modalidades Terapêuticas nas Disfunções Estéticas, SP: Phorte, 2010.

5. Schmitt YS, Hoffman HG, Blough DK, Patterson DR. et al. A randomized, controlled trial of immersive virtual reality analgesia, during physical therapy for pediatric burns. Burns. 2011; 37(1): 61-82.

6. Bosch PR, Poloni J, Thornton A, Lynskey JV. The Heart Rate Response to Nintendo Wii Boxing in Young Adults. Cardiopulm. Phys. Ther. j. 2012;23(2):13-29.

7. Cacau LAP, Oliveira GU, Maynard LG, et al. The use of the virtual reality as intervention tool in the postoperative of cardiac surgery. Rev Bras Cir Cardiovasc 2013;28(2):281-289.

8. Gonçalves GB, Leite MA, Orsini M, Pereira JS. Effects of using the nintendo wii fit plus platform in the sensorimotor training of gait disorders in Parkinson's disease. Int. j. neurol. 2014;6(1):5048.

9. Barry G, Galna B, Rochester L. The role of exergaming in Parkinson's disease rehabilitation: a systematic review of the evidence. J Neuroeng Rehabil. 2014;11: 33.

10. Choi JH, Han EY, Kim BR, et al. Effectiveness of commercial gamingbased virtual reality movement therapy on funcion al recovery of upperextremity in subacute stoke patientes. Ann Rehabil Med 2014;38(4):485-493.

11. American Thoracic Society/European Respiratory Society. ATS/ERS Statement on respiratory Muscle Testing. J Respir Crit Care Med. 2002;166:518-624.

12. Riberto M, Miyazaki MH, Jucá SSH, Sakamoto H, Pinto PPN, Battistella LR - Validação da Versão Brasileira da Medida de Independência Funcional. Acta Fisiatr 2004;11(2):72-76.

13. Echevarria-Guanilo ME, Dantas RA, Farina JA Jr, Faber AW, Alonso J, Rajmil L, Rossi LA. Reliability and validity of the Brazilian-Portuguese version of the Burns Specific Pain AnxietyScale (BSPAS). Int J Nurs Stud. 2011; 48(1): 47-55.

14. American Thoracic Society (ATS). ATS statement: guidelines for the six-minute walk test. J Respir Crit Care Med. 2002;166 (1):111-117.

Revista ARACÊ
ISSN: 2358-2472

15. Rostagno C, Olivo G, Comeglio M, Boddi V, Banchelli M, Galanti G, Prognostic value of 6-minute walk corridor test in patients with mild to moderate heart failure: comparison with other methods of functional evaluation, Eur J Heart Fail. 2003;5(3):247-252.

16. Aquino ES, Mourão FA, Physical et al., Comparative analysis of the six-minute walk test in healthy children and adolescents, Rev Brasil. Fisioter. 2010;14(1):75-80.

17. Torquato JA, Pardal DM, Lucato JJ, Fu C, Gómez DS. O curativo compressivo usado em queimadura de tórax influencia na mecânica do sistema respiratório? Rev Bras Queim. 2009; 8(1):28-33.

18. Billinger SA, Coughenour E, MacKay-Lyons MJ, Ivey FM. Reduced Cardiorespiratory Fitness after Stroke: Biological Consequences and Exercise-Induced Adaptations. Stroke Res Treat. 2012;2012:959120.

19. Ache JD, Ovando AC, Külkamp W, Borges NG. Força de preensão palmar: uma revisão. Rev Bras cineantropom desempenho Hum. 2010;12(3):209-216.

20. Meldrum D, Cahalane E, Conroy R et al. Quantitative assessment of motor fatigue: normative values and comparison with prior-polio patients. Amyotroph Lateral Scler. 2007;8(3):170-176.

21. Caruso P, Luis A, Albuquerque P, et al. Diagnostic methods to assess inspiratory and expiratory muscle strength. J Bras Pneumol. 2015;41(2):110-123.

22. Kumar SP. Efficacy of segmental stabilization exercise for lumbar segmental instability in patients with mechanical low back pain: a randomized placebo controlled crossover study. N Am J Med Sci. 2011;3:456–461.

23. Ezechieli M, Siebert CH, Ettinger M, et al. Força muscular da coluna lombar em diferentes esportes. Technol Health Care. 2013;21:379-386.

24. ChangWD, Lin HY, Lai PT. Core strength training for patients with chronic low back pain. J Phys Ther Sci. 2015;27(3):619-622.

25. Mohammadian M, Choobineh A, Haghdoost A, Hasheminejad N. Normative data of grip and pinch strengths in healthy adults of Iranian population. Iran J Public Health. 2014;43(8):1113–1122.

26. Puh U. Age-related and sex-related differences in hand and pinch grip strength in adults. Int J Rehabil Res. 2010;33:4–11.

27. Mesquita TMJC, Gardenghi G. Imobilismo e fraqueza muscular adquirida na unidade de terapia intensiva. Revis. Bras. Saúde Funcional. 2016;1(3);1-12.

28. Wu X, Baer LA, Wolf SE, Wade CE, Walters TJ. The impact of muscle disuse on muscle atrophy in severely burned rats. JSurg Res.2010; 164(2):243-25.

Revista ARACÊ
ISSN: 2358-2472

29. Bailey P, Thomsen GE, Spuhler VJ, Blair R, Jewkes J, Bezdjian L, et al. Early activity is feasible and safe in respiratory failure patients. Critical Care Medicine. 2007;35:139–145.

30. Krentz JR, Farthing JP. Neural and morphological changes in response to a 20-day intense eccentric training protocol. Eur J Appl Physiol. 2010;110(2):333-340.

31. Truong AD, Fan E, Brower RG, Needham DM. Bench-to-beside review: mobilizing patients in the intensive care unit from pathophysiology to clinical trials. Crit Care. 2009;13(4):216.

32. Folland JP, Williams AG. The adaptations to strength training: morphological and neurological contributions to increased strength. Sports Medicine 2007;37(2):145-168, 2007.

33. Gerrard P, Goldstein R, Divita MA, Ryan CM, Mix J, Niewczyk P, Kazis L, Kowalske K, Zafonte R, Schneider JC. Validity and reliability of the FIM instrument in the inpatient burn rehabilitation population. Arch Phys Med Rehabil. 2013;94(8):1521-1526.

34. Kimura Y, Yamada M, Hamanaka K, Tanaka N, Muroh Y. Usefulness of the prediction method based on a logarithmic model for functional recovery in stroke patients: in case of using the motor functional Independence Measure score. Int J Rehabil Res. 2017;40(2):134-137.

35. Tabata M, Shimizu R, Kamekawa D, et al. Six-Minute Walk Distance Is an Independent Predictor of Hospital Readmission in Patients With Chronic Heart Failure. Int Heart J. 2014;55(4):331-336.

36. Mazzoleni S, Montagnani S, Vagheggini G, Buono L, Moretti F, Dario P, Ambrosino N. Interactive videogame as rehabilitation tool of patients with chronic respiratory diseases: Preliminary results of a feasibility study. Respir Med. 2014;108(10):1516-1524.

37. Simões LA, Dias JMD, Marinho KC, Pinto CLLR, Britto RR. Relações da função muscular respiratória e de membros inferiores de idosos comunitários com a capacidade funcional avaliada por teste de caminhada. Rev Bras Fisio. 2010;14(1):24-30.

38. Veloso-Guedes CA1, Rosalen ST, Thobias CM, et al. Validation of 20-Meter Corridor for the 6-Minute Walk Test in Men on Liver Transplantation Waiting List, Transplantation proceedings 2011;43(4):1322-1324.

39. Subtil MML, Goes DC, Gomes TC, de Souza ML. O Relacionamento Interpessoal e a Adesão na Fisioterapia. Fisioter Mov. 2011; 24(4):745-753.

40. Medeiros LG, Almeida RMM, Rigoli MM, Kristensen CH. Transtornos psiquiátricos em pacientes vítimas de queimaduras. Psicologia: teoria e prática. 2012;14(2):56-65.

41. Davydow DS, Katon WJ, Zatzick DF. Psychiatric morbidity and functional impairment in survivors of burns, traumatic injuries, and ICU stays for other critical illnesses: A review of the literature. International Review of Psychiatry. 2009;21:531–538.

Revista ARACÊ
ISSN: 2358-2472

42. Medeiros LG, Kristensen CH, Almeida RMM. Estresse pós-traumático, ansiedade e depressão em vítimas de queimaduras. Arq. Bras. Psicol. 2010;62(1):148-158.

43. Costa GOP, Silva GA, Santos AG. Perfil clínico e epidemiológico das queimaduras: evidências para o cuidado de enfermagem. Rev Cienc Saud. 2015;8(3):146-155.

44. Morris LD, Louw QA, Grimmer-Somers K. The effectiveness of virtual reality on reducing pain and anxiety in burn injury patients: a systematic review. Clin J Pain. 2009; 25(9):815-826.

45. Hoffman HG, Doctor JN, Patterson DR, et al. Use of virtual reality as an adjunctive treatment of adolescent burn pain during wound care: A case report. Pain. 2000;85:305–309

46. Sharar SR, Carrougher GJ, Nakamura D, Hoffman HG, Blough DK, Patterson DR. Factors influencing the efficacy of virtual reality distraction analgesia during postburn physical therapy: preliminary results from 3 ongoing studies. Arch Phys Med Rehabil. 2007;88(2):43-49.

47. LEE G. Effects of Training Using Video Games on the Muscle Strength, Muscle Tone, and Activities of Daily Living of Chronic Stroke Patients. J Phys Ther Sci. 2013;25(5):595-597.