



Effectiveness of Exergames Using Nintendo Switch Sports for Rehabilitation with Stage 3 Frozen Shoulder

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Abstract

This study examined the effectiveness of exergames rehabilitation using the Nintendo Switch Sports in the rehabilitation of patients diagnosed with Stage 3 Frozen Shoulder, also known as Adhesive Capsulitis. The participants consisted of 10 individuals of all genders who were medically diagnosed with Frozen Shoulder and were undergoing rehabilitation. A randomized controlled trial was employed to compare outcomes between the control and experimental groups data was collected using the Shoulder Pain and Disability Index (SPADI) and Range of Motion (ROM) assessments before and after the intervention. Results showed that both groups demonstrated improvement in shoulder range of motion and decreased pain and disability. However, statistical analysis revealed no significant difference between the control and experimental groups. These findings indicate that exergame rehabilitation contributed to patient improvement, its effects were comparable to those of conventional therapy. The use of exergames may enhance the patient's engagement, motivation, and adherence to rehabilitation programs. The study concludes that exergames can be considered a useful adjunct to traditional therapy in improving functional outcomes and participation among the patients with Stage 3 Frozen Shoulder.

Keywords: Exergames; Frozen Shoulder; Rehabilitation; Nintendo Switch Sports; SPADI; Range of Motion

Introduction

Frozen shoulder or adhesive capsulitis is a condition wherein the shoulder joint capsule has inflammation and thickening leading to persistent pain and stiffness of the joint. These symptoms often progress slowly, severely limiting a patient's range of motion (ROM) and hindering their ability to perform daily activities.

The condition progresses through four stages: the painful stage, freezing stage (3 to 9 months), frozen stage (9 to 15 months), and thawing stage (15 months to 2 years), with symptoms gradually resolving over time [2]. It commonly affects individuals aged 40 to 69 years old, particularly women, and is associated with conditions such as diabetes and thyroid disorder, although it may occur after the injury or surgery [5]. This condition significantly impairs basic activities such as grooming and dressing, highlighting the need for timely and effective rehabilitation. Management of frozen shoulder is typically non-surgical and may take up to three years, focusing on pain relief and restoration of range of motion through physical therapy, medications such as NSAIDs, and corticosteroid injections (PubMed, 2019). Conventional physical therapy includes range-of-motion exercises, stretching, strengthening, and home exercise programs; however, patient motivation and long-term adherence remain common challenges (Mayo Clinic, 2022). Recent advancements in interactive gaming technology, such as Nintendo Sports, present a potential adjunct to traditional rehabilitation. These motion-based games require coordinated shoulder movements and may improve both engagement and functional outcomes. Evidence from studies like [4] suggests that gaming-based rehabilitation can enhance range of motion and patient participation through interactive feedback. However, there is limited research on its effectiveness specifically for individuals with stage 3 frozen shoulder. Supporting this approach, Mangal et al. (2017) demonstrated that interactive gaming systems, such as the Kinect rehabilitation system, significantly improved range of motion and patient participation. The real-time feedback and immersive nature of such technologies increased patient engagement and contributed to better rehabilitation outcomes. Despite these promising findings, there remains limited research specifically examining the effectiveness of Nintendo Sports in improving range of motion and functional movements in individuals with stage 3 frozen shoulder.



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Methods

This study employed a Randomized Controlled Trial (RCT), to determine the improvement in range of motion and activities of daily living along with Stage 3 Frozen Shoulder through the use of exergames using Nintendo Switch Sports. Participants were randomly assigned to either the control group or the experimental group to ensure a structured comparison between interventions. This design is considered the gold standard in evaluating intervention outcomes due its ability to minimize bias and enhance the validity of the results. A pretest-posttest was utilized to measure the changes in shoulder range of motion and functional activity before and after the intervention.

Results and Discussion

This chapter presents the analysis and interpretation of the data gathered to determine the improvement in range of motion and functional activities among patients with stage 3 Frozen Shoulder (Adhesive Capsulitis). Following the conventional therapy and exergames intervention using Nintendo Switch Sports. The Shoulder Pain and Disability Index (SPADI) and Range of Motion (ROM) assessments were used as outcome measures. The problems were guided to Chapter 1 of the Research.

It can be seen from the data (n=5), that the participants in control group exhibited limited shoulder range of motion across all the movements. Among the active range of motion, flexion obtained the highest mean 102, followed by abduction with 100. External rotation recorded a mean of 64, while internal rotation showed the lowest of 54.

For Passive Range of Motion, Flexion also obtained the highest mean of 114, followed by abduction at 111. External rotation had a mean of 71, while internal rotation showed the lowest mean of 59.

The Shoulder and Disability Index (SPADI) revealed a mean score of 0.81, indicating a high level of pain and disability among the respondents prior to intervention.

The table 2 presents that the participants in the experimental group also exhibited limited shoulder ROM. among the active range of motion, abduction obtained the highest mean of 111, followed by flexion at 110. External rotation had a mean of 64, while internal rotation showed the lowest mean of 56.

For the Passive Range of Motion, abduction recorded the highest mean of 113, followed by flexion at 102. External rotation had a mean of 71, while internal rotation obtained a mean of 60.

The SPADI results showed a mean score of 0.85, indicating a high level of pain and disability among the participants before the intervention.

The table 3 shows that the data from the control group obtained a mean SPADI score of 0.81, while the experimental group recorded a mean of 0.84. The results show that both groups have similar level of pain and disability prior to the intervention, indicating that the participants are comparable at baseline.

Table 4 data that the control group obtained a mean shoulder flexion of 147, while the experimental group recorded 130. For abduction, the control group had 138, while the experimental group had 130. In external rotation, the control group obtained 85, while the experimental group 81. Both groups showed the same mean of 71 in internal rotation.

Table 1: Pre-test Shoulder ROM among the Control Group.

Movement	Mean	SD	Min	Max
AROM Flexion	102	28.42	80	150
AROM Abduction	100	24.49	70	130
AROM External Rotation	64	11.94	55	85
AROM Internal Rotation	54	8.22	45	60
PROM Flexion	114	21.62	95	150
PROM Abduction	111	19.81	85	135
PROM External Rotation	71	11.40	60	90
PROM Internal Rotation	59	7.42	50	70
SPADI	0.81	0.22	0.43	0.96

Table 2: Pre-test Shoulder ROM among the Experimental Group.

Movement	Mean	SD	Min	Max
AROM Flexion	110	35.18	85	170
AROM Abduction	111	42.19	70	170
AROM External Rotation	64	5.48	60	70
AROM Internal Rotation	56	12.94	45	70
PROM Flexion	102	9.75	95	115
PROM Abduction	113	42.22	85	180
PROM External Rotation	71	5.48	65	80
PROM Internal Rotation	60	11.18	55	80
SPADI	0.85	0.18	0.63	1.10

Table 3: Comparison of Pre-test SPADI Scores.

Movement	Groups	Mean
Pretest SPADI	Control	0.81
Pretest SPADI	Experimental	0.84

The computed p-values for flexion (0.526), abduction (0.585), external rotation (0.606), and internal rotation (1.000) are all greater than 0.05, indicating that there is no significant difference between the two groups.

Table 5 the control group obtained a mean flexion of 140°, while the experimental group 122°. In abduction, the control group had 133°, while the experimental group had 123°. Both groups showed the same mean of 84° in external rotation. For internal rotation, the control group obtained 67°, while the experimental group 68°.

The computed p-values for flexion (0.591), abduction (0.371), external rotation (1.000), and internal rotation (0.881) are all greater than 0.05, indicating that there is no significant difference between the two groups.

Table 6 the data during the pretest, the control group obtained a mean SPADI score of 0.81, while the experimental group recorded 0.84. During posttest, the control group showed a decrease mean score of 0.29, while the experimental group had 0.43.

The computed p-values for pretest (0.916) and posttest (0.074) are greater than 0.05, indicating that there is no significant difference between the two groups. However, both groups showed a decrease in SPADI scores, meaning that improvement in pain and disability.

Table 7 shows the mean rank values between the control and experimental group were similar across all the shoulder motion. The

Table 4: Post-test PROM Comparison.

Movement	Groups	Mean	Statistic (Mann-Whitney U)	p-value	Decision	Conclusion
Flexion	Control	147°	9.500	0.526	Accept Null	NOT Significant
	Experimental	130°				
Abduction	Control	138°	10.000	0.585	Accept Null	NOT Significant
	Experimental	130°				
External Rotation	Control	85°	10.500	0.606	Accept Null	NOT Significant
	Experimental	81°				
Internal Rotation	Control	71°	12.500	1.000	Accept Null	NOT Significant
	Experimental	71°				

Table 5: Post-test AROM Comparison.

Movement	Groups	Mean	Statistic (Mann-Whitney U)	p-value	Decision	Conclusion
Flexion	Control	140°	10.000	0.591	Accept Null	NOT Significant
	Experimental	122°				
Abduction	Control	133°	8.500	0.371	Accept Null	NOT Significant
	Experimental	123°				
External Rotation	Control	84°	12.500	1.000	Accept Null	NOT Significant
	Experimental	84°				
Internal Rotation	Control	67°	12.000	0.881	Accept Null	NOT Significant
	Experimental	67°				

Table 6: SPADI Comparison (Pretest & Posttest).

Movement	Groups	Mean	Statistic (Mann-Whitney U)	p-value	Decision	Conclusion
Pretest SPADI	Control	0.81	12.000	0.916	Accept Null	NOT Significant
	Experimental	0.84				
Posttest SPADI	Control	0.29	4.000	0.074	Accept Null	NOT Significant
	Experimental					

Table 7: Comparison of AROM (Posttest).

Movement	Groups	Mean Rank	Statistic (Mann-Whitney U)	p-value	Decision	Conclusion
Flexion	Control	6	10.000	0.591	Accept Null	NOT Significant
	Experimental	5				
Abduction	Control	6.3	8.500	0.371	Accept Null	NOT Significant
	Experimental	4.7				
External Rotation	Control	5.5	12.500	1.000	Accept Null	NOT Significant
	Experimental	5.5				
Internal Rotation	Control	5.4	12.000	0.881	Accept Null	NOT Significant
	Experimental	5.0				

computed p-values for flexion (0.591), abduction (0.371), external rotation (1.000), and internal rotation (0.881) are all greater than 0.05.

These results indicate that there is no significant difference between the control and experimental groups in terms of Active shoulder range of motion after the intervention.

Conclusion and Recommendations

It can be concluded from the findings of the study that both conventional and exergame rehabilitation using the Nintendo Switch Sports resulted in improvement in shoulder range of motion

and reduction of pain and disability among patients with Stage 3 Frozen Shoulder. The results further show that patients in the experimental group demonstrated improvement following the exergame intervention. However, these improvements were not significantly different from those patients in the control group who underwent conventional therapy. This indicates that while exergame are beneficial in rehabilitation, their effectiveness is comparable to, but not greater than, conventional treatment. Based on these findings, it is recommended that the exergames using Nintendo Switch Sports may be utilized as a supplementary, adjunct, or alternative rehabilitation approach, as it provided therapeutic outcomes that

offer a more engaging and interactive treatment session for the patients. Furthermore, the future researchers are encouraged to conduct studies with a larger number of participants and longer duration of intervention to further examine the potential differences between the two groups.

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