A QUALITATIVE STUDY EXPLORING THE IMPACT OF A MODIFIED PS4 DUALSHOCK CREATED BY AN OCCUPATIONAL THERAPIST ON THE QUALITY OF LIFE AND WELLBEING OF QUADRIPLEGIC SPINAL CORD INJURY PATIENTS IN RIYADH, SAUDI ARABIA

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ABSTRACT

Objectives: The aims of this study are to explore (a) the perceptions of quality of life and wellbeing among people living with quadriplegic spinal cord injuries; (b) how the modified PlayStation4 DualShock controller influences their quality of life and wellbeing – with consideration to the factors participants identify as contributing to, enabling, or constraining the quality of their lives; and (c) if the DualShock controller modification enabled participants to recognize that, with the right adaptations, they could engage in some of their meaningful pre-injury occupations and be motivated to consider the possibility of attempting new meaningful occupations and hobbies post-injury.

Methods: A qualitative methodology and an exploratory design were used. Semi-structured interviews with both men (*n*=6) and women (*n*=1) were completed with people who have quadriplegic spinal cord injuries (C5–C6) and an interest in gaming. Interpretive analysis was grounded in the themes that arose from the interview transcripts. The participants were recruited from a rehabilitation hospital in Riyadh, Saudi Arabia.

Results: The time since onset of injury ranged from one to fourteen years. The mean age was 27 years old with an age range from 18 to 45 years old. The study respondents living with quadriplegic spinal cord injuries claimed that the disability significantly affected their quality of life, as they became dependent on others, leading to subsequent depression. The use of a modified PlayStation4 DualShock controller improved their quality of life and wellbeing by enabling them to participate in a meaningful leisure activity. Three of the seven participants reported and reflected that they felt motivated after trying the modified DualShock controller. They also shared that they were subsequently willing to attempt new activities and resume hobbies with the help of their occupational therapists. As for the other four participants, they expressed a desire to return to gaming via using the modified DualShock controller.

Conclusion: The study findings suggest that life with quadriplegic spinal cord injuries can be rich and fulfilling if occupational therapists are prepared to embrace the use of assistive technology, such as the modified DualShock controller.

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1. CHAPTER ONE

1.1. Introduction

Quadriplegic spinal cord injury (QSCI) is a severe medical condition that often results in permanent disability (Eckert and Martin 2017). QSCI is defined as the impairment or loss of motor function or sensory function in the cervical segments of the spinal cord as a result of damaged neural elements within the spinal canal (Kirshblum et al., 2011). This condition results in the functional impairment of the arms, trunk, legs, and pelvic organs (Nas 2015). The QSCI causes irreversible and permanent physical damage, which often provokes severe impairment, to the individual. Therefore, the unexpected onset of a QSCI is considered one of the most painful and disastrous experiences that an individual can survive (Bracken and Shepard, 1980; De Santo-Madeya, 2006; Dibb et al., 2014). The functional outcomes of a QSCI are strongly connected with the neurologic level of a patient's spinal cord injury (SCI; AlHuthaifi et al. 2016).

According to Weitzner et al. (2011), a QSCI impacts a person's self-esteem, daily functioning, and social interactions. Psychopathological conditions associated with spinal cord damage are common and may include depression and anxiety (Craig et al. 2009; Kennedy et al. 2013).

QSCI users of the various forms of assistive technology (AT) reported that they felt less dependent on caregivers; the technology offered them a sense of freedom and enabled them to complete tasks by themselves (Folan et al., 2015; Myberg et al., 2017; Hooper et al., 2018; Verdonck et al., 2018; Gottlieb et al. 2019). Patients reported an elevated level of autonomy and participation in functional activities. As Brekke et al. (2019) note, the capacity to engage in meaningful and purposeful activities is a critical aspect of quality of life (QoL).

Occupational therapy (OT) is widely regarded as a creative profession, both as a practice and in its application of creative activities to benefit clients (Schmid, 2004). The practice was founded on the idea that encouraging meaningful activities has therapeutic value (Levine, 1987). Meaning is created in an activity through identifying characteristics that motivate or inspire participation (La Cour, Josephsson, and Luborsky, 2005). Facilitating activities that are tailored to an individual necessitates a complex level of problem-solving and client comprehension (Marcus, 2014).

Furthermore, finding a balance between humanity and science has been at the heart of OT philosophy since its inception (Reilly, 1962). Concerning creativity, it is critical to be creative with patients because creativity provides patients with joy, boosts their self-esteem (La Cour et al., 2005), and allows them to solve unique problems (Graham, 1983).

In occupational science and occupational therapy, occupational justice is an evolving concept (Sakellariou and Pollard, 2017a). Nielsson and Townsend (2010) describe it as a powerful idea that bridges the gap between people's wellbeing and social conditions that limit their potential. Occupational justice, according to Studnyk et al. (2010), refers to the right of people to engage in meaningful occupations that promote health, wellbeing, and quality of life. For occupational therapists, such occupations bring about occupational justice in people's everyday lives (Whiteford and Townsend, 2011). Occupational science theory focuses on the therapy through which people know how discipline can be maintained in a particular area. Further, occupational science has developed into an academic order that produces information related to people and their lived experiences, their occupations, and their networks. These areas shape the human experience, according to Lawlor (2020). Yet Pierce (2001) notes that occupation is not synonymous with activity in the view of many individuals or people in general. In this context, gaming for some people who access OT, such as people with a QSCI, may be a meaningful activity.

Moreover, the PlayStation4 (PS4) DualShock controller is Sony Interactive Entertainment's first gamepad for their PS4 home video game platform (PlayStation controller - Wikipedia, 2022). The PS4 DualShock controller is more than just an input device that allows the player to perform actions in the video game. It also allows the player to manipulate the game’s environment through use of the controller (Blomberg 2018).

However, for people living with physical disabilities, no modification or adaptation has been implemented so that a disabled user can reach the rear triggers on the PS4 DualShock controller **(Figure 1),** which is a critical part of PS4 gaming. As a result, the researcher, an occupational therapist, created this modification for people with a QSCI to use while playing PS4. The DualShock controller was modified to have specific triggers that can be used within games requiring input via specific buttons. However, those with a QSCI are unable to physically perform these functions **(Figure 2).**

Figure 1. Rear triggers for DualShock controller

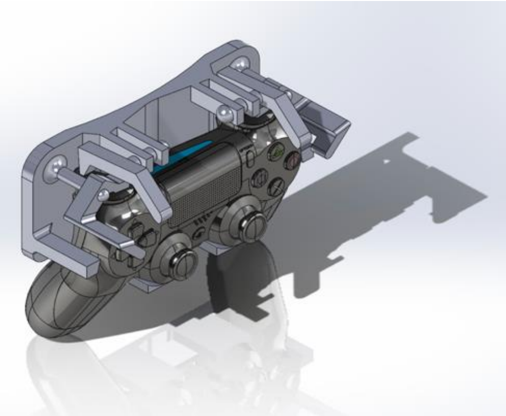

Figure 2. Isometric view of the modification with the controller

Accordingly, the aim of this qualitative study is to determine whether (and how) people with QSCIs can reconstruct lives that are worth living, through attempting the meaningful activities that were accomplished prior to their injuries. Given the identified benefits of video game playing and the prevalence of QSCI in the Kingdom of Saudi Arabia (KSA), this study explored the influence of applying a modification to the PS4 DualShock controller so that it can be used by adult patients with a QSCI in a rehabilitation hospital in Riyadh, Saudi Arabia. For this study, high QoL and wellbeing are conceptualised as the experience of a life worth living.

1.2. Study Rationale

The Kingdom of Saudi Arabia is the largest country in the Middle East. It occupies nearly four-fifths of the Arabian Peninsula and has a population of over 28 million people; it also has one of the highest rates of QSCI in the world (Robert and Zamzami 2013). Nevertheless, research on the QoL and wellbeing of people with QSCIs in KSA has been minimal with existing studies investigating the long-term incidence of QSCI in KSA (Robert and Zamzami, 2013).

Furthermore, QoL studies exploring QSCI patients have been limited through primarily focusing on the practical, physical, or psychological concerns or symptoms reported by patients (QoL as patient-reported outcomes: principles of assessment, 2014). However, only a few local Saudi Arabia studies have focused on QSCI patients' QoL and wellbeing. Furthermore, it seems that minimal research has been conducted in Saudi Arabia concerning the factors that influence impairment acceptance in QSCI patients.

Finally, according to Hammell (2004a), there is growing recognition of the value of qualitative research methods for investigating individuals' perceptions of the quality of their own lives and the factors that they believe contribute to the experience of a high QoL following a QSCI. Nonetheless, there appears to be no qualitative research into the QoL perspectives of people with a QSCI.

As a result, the purpose of this qualitative study is to ascertain whether and how persons with a QSCI can reconstruct lives worth living. Additionally, this study focuses on the elements QSCI patients describe as contributing to, enabling, or restraining the quality of their lives. Although several researchers have explored QoL among people with a SCI via qualitative methods (Duggan et al. 2002), exploring QoL perceptions of people with a QSCI may still be lacking (Hammell 2004b). Therefore, the aim of this study is to examine how a modified PS4 DualShock controller can affect the QoL and wellbeing for people living with a QSCI.

1.3. Research Objectives

1.3.1. General objective and study aim

The primary objective of the study is to explore the impact of a modified PS4 DualShock controller created by an occupational therapist on the QoL and wellbeing of QSCI patients in Riyadh, Saudi Arabia.

1.3.2. Specific objectives

The specific objectives of this study are as follows:

i. To assess the coping mechanisms of QCSI patients concerning their physical impairment, daily obstacles they face, and the subsequent effect on QoL and wellbeing.

ii. To assess the efficacy of the DualShock controller modification for use by QSCI patients; and

iii. To determine whether the DualShock controller modification may enhance the QoL and wellbeing of patients with a QSCI.

1.4 Overview of Subsequent Chapters

In **Chapter 2,** a critical overview of the current literature is provided to explore the current knowledge about OT, QoL and wellbeing, QSCI, and gaming. In the literature review, studies focused on these elements are examined. **Chapter 3** focuses on describing the research steps taken for this study and justification of the methodology used in conducting this research project. **Chapter 4** presents the key findings and further theoretical discussions relevant to the findings of this research project. Finally, **Chapter 5** presents the conclusion of the dissertation, which includes limitations to the study, implications of the findings on OT, and future recommendations based on the key findings.

1.5 Summary

When people are confronted with painful events and losses, they may find meaning in them, which helps them better adjust (Davis and Novoa, 2013; De Roon-Cassini et al., 2009; Thompson et al., 2003). Individuals with a QSCI are forced to adapt due to the significant changes they experience in physical, cognitive, and functional autonomy (Bonanno et al., 2012). Moreover, a QSCI has been linked to decreased life satisfaction and lower QoL (Martz et al., 2005; Kemp and Krause, 1999). However, although some experts believe that people with a QSCI are expected to experience acute psychological decompensation, some people with a QSCI can adapt well (Bonanno et al., 2012).

The goal of this qualitative study is to discover and characterise the essence and significance of experiencing creative intervention through use of a modified DualShock controller after a QSCI, as described by seven people who have a QSCI and tried the modified PS4 DualShock controller.

2. CHAPTER TWO

2.1. Literature Review

Having shared the research objectives and aims of the study, it is crucial to refer to the empirical studies that investigate the QoL and wellbeing of people with a QSCI. This literature review critiques studies about OT and the rehabilitation of patients with a QSCI. This chapter begins with a description of the literature search strategy used. This is followed by a critical review of the current role of OT with QSCI patients and the importance of creativity in OT treatment for people with a QSCI. Furthermore, past studies regarding QoL and wellbeing of people with a QSCI are discussed, highlighting the leisure repertoire among persons with a QSCI. Then, emotional, and psychological impacts after the injury are addressed because *significant* long-term health *impacts* in young adults may cause depression and anxiety. In addition, the importance of AT and gaming for people with a QSCI is considered in the context of QoL. Finally, at the end of this chapter, the research gap is discussed.

2.1.1. **Literature Search Strategy**

The overall research question guiding this study was: *What effect does a PS4 modified DualShock Controller created by OT had on patients with QSCI's QoL, wellbeing, and psychological well-being? and how do AT help individuals with QSCI?*

A broad search was performed of available literature to answer the questions on how the QoL, and wellbeing is affected after QSCI, is there a psychological impact after QSCI, and the importance of gaming for people with QSCI. Initially, a general Google search was done to identify potential keywords. After that, CINAHL (EBSCO), PsycINFO (Ovid), and Scopus databases were used to search for relevant content. For the purpose of justifying the researcher decision on choosing these databases, The CINAHL database is mentioned as one of the best sources of primary studies needed for qualitative evidence synthesis (Wright, Golder, and Lewis-Light, 2015). Whereas PsycINFO contributes papers on psychological and psychiatric themes that are not available in other databases, according to studies comparing database yields (Eady, Wilczynski and Haynes, 2008). In terms of Scopus, it is the world's largest abstract and citation database for peer-reviewed literature, including publications in journals, books, and proceedings from conferences. Scopus has a larger dataset; therefore, metrics will be available for more articles, journals, and conference papers. (Burnham, 2006).

By using the Boolean operators 'AND' and 'OR', comprehensive and accurate results were obtained (Cronin et al. 2008). **Table 1** shows the databases and keywords used in the search process. Gray literature was not included due to time constraints associated with completing a Master of Science (MSc).

Table 1 Databases and keywords used during the search process

Database	Keywords
CINAHL (EBSCO)	Spinal Cord injury OR SCI **(AND)** Quality of Life OR QoL **(AND)** Assistive Technology OR AT **(AND)** Wellbeing OR Acceptance **AND)** Occupational therapy
PsycINFO (Ovid)	Spinal Cord injury OR SCI **(AND)** Quality of Life OR QoL **(AND)** Quadriplegia **AND)** Occupational therapy
Scopus	Spinal Cord injury OR SCI

	(AND) Quality of Life OR QoL **(AND)** Quadriplegia **(AND)** Assistive Technology OR AT **(AND)** Occupational therapy

Inclusion criteria for this review were: research studies that reported and focused on managing QSCI patients' disabilities and assess the impact of technological interventions on the QoL and wellbeing in this population. As well as, how creating modification by OT affect the independence of people with QSCI.

Papers were excluded if they were focused on paediatric populations, specific diagnostic groups, such as: Multiple Sclerosis, Parkinson's, and Alzheimer's. Finally, were written in a language other than English.

Six search terms were used to search the databases with the article title, abstracts and body all searched. The search terms used were:

- Spinal Cord injury
- Quality of Life
- Assistive Technology
- Well-being
- Quadriplegia
- Occupational Therapy

Prior to conducting the search in all engines, the search terms were tested to ensure they were effective in locating the types of articles that met the inclusion criteria.

Search terms and results were documented sequentially using search engines **(Table 2)**

Table 2 Search results for QoL and wellbeing after QSCI, the psychological impact after QSCI, and how do AT help individuals with QSCI

Search engine	Search (S) terms	# Retrieved: (numbers in brackets used in combined searches)	# Met inclusion criteria	Table 3 Article ID
CINAHL	S1 Spinal Cord injury	(21,459)		
	S2 Quality of Life	(60,409)		
	S3 Assistive Technology	(2,504)		
	S4 Well-being	(14,104)		
	S5 Quadriplegia	(1,955)		
	S7 Occupational Therapy	(31,526)		
	S6 S1 and S2	12	2	1, 2
	S7 S2 and S5	1	0	
	S8 S1 and S3	9	2	5, 6
	S9 S1 and S4	1	0	
	S10 S3 and S5	9	0	
	S11 S5 and S7	49	1	2
Totals		81	5	
PsycINFO (Ovid)	S1 Spinal Cord injury	(7271)		
	S2 Quality of Life	(44,264)		
	S3 Assistive Technology	(2514)		
	S4 Well-being	(51,876)		
	S5 Quadriplegia	(225)		
	S7 Occupational Therapy	(11,400)		
	S6 S1 and S2	(212)		
	S7 S2 and S5	10	1	4
	S8 S1 and S3	36	0	
	S9 S1 and S4	81	1	1
	S10 S3 and S5	15	1	3
	S11 S5 and S7	12	0	
Totals		142	3	
Scopus	S1 Spinal Cord injury	(3809)		
	S2 Quality of Life	(51,085)		

	S3 Assistive Technology	(6495)		
	S4 Well-being	(39,800)		
	S5 Quadriplegia	(82)		
	S7 Occupational Therapy	(37,116)		
	S6 S1 and S2	192	1	1
	S7 S2 and S5	14	0	
	S8 S1 and S3	47	0	
	S9 S1 and S4	109	1	2
	S10 S3 and S5	12	2	5, 3
	S11 S5 and S7	81	1	2
Totals		455	5	

The relevance of each article has been assessed by reading the abstract (and where necessary, the entire paper) using the inclusion and exclusion criteria to exclude those papers that were not relevant to this review.

To avoid duplication of search results, articles that met the inclusion criteria were selected and documented **(Table 2),** and in a summary table **(Table 3).** Additionally, each article was entered into a reference management database (Mendeley) along with the search term and engine where it was located.

Subsequent searches were compared with the summary table for all articles found in the initial search, and duplicates were eliminated. Each article meeting the inclusion criteria was summarised on this table **(Table 3).**

Table 3 Summary of articles: QoL and wellbeing after QSCI, the psychological impact after QSCI, and how do AT help individuals with QSCI

	Author (year) country and sites	**Study design**	**Sample size and sites**	**Comments/key findings**
1	Loy, D., Dattilo, J. and Kleiber, D., 2003. Exploring the Influence of Leisure on Adjustment: Development of the Leisure and Spinal Cord Injury Adjustment	Research questions were addressed through structural equation modelling (SEM)	178 individuals with SCI at a community therapeutic recreation	Leisure engagement was found to directly influence SCI adjustment as well as to promote social support that influenced the adjustment of individuals with SCI. These results demonstrate the

	Model. *Leisure Sciences*, 25(2-3), pp.231-255. USA	to create an approximate representation of the relationship between leisure engagement and SCI adjustment.	centre in the south-eastern United States	importance of perceived social support in the adjustment process to SCI, indicating that leisure engagement contributes to the formation of social support that positively affects adjustment.
2	Nas, K., 2015. Rehabilitation of spinal cord injuries. *World Journal of Orthopedics*, 6(1), p.8.	qualitative method involving systematic reviews: a comprehensive review of all relevant studies	11 clinical studies related to the rehabilitation of patients with spinal cord injury	In absence of daily activities, social and psychological problems can arise. Occupational therapy and determining the role of the patient in society are the main factors in restoring the psychological state. Suicide attempts have been reported due to a lack of daily activity, depression, alcohol dependence and emotional distress. Occupational therapy allows SCI patients to be more social, to use their own functions for creative jobs and to deal with psychological problems like depression.
3	Baldassin, V., Shimizu, H. and Fachin-Martins, E., 2018. Computer AT and associations with quality of life for individuals with spinal cord injury: a systematic review. *Quality of Life Research*, 27(3), pp.597-607. Brazil.	Systematic review	there is evidence that AT for computer access favours the quality of life of people with tetraplegia due to SCI, since it improves participation, independence, and self-esteem.	there is evidence that AT for computer access favours the quality of life of people with tetraplegia due to SCI, since it improves participation, independence, and self-esteem.
4	Nerisanu, R., Nerisanu, R. A., Maniu, I., and Neamtu, B. (2017). Cerebral palsy and eye-gaze technology - interaction, perspective, and usability: A review. Acta Medica Transilvanica, 22(4), 59-62. Transylvania	Systematic review	data collection strategy involved several online resources, and journals were used as the materials for the research	major influence of AT on cerebral palsy patients, including the level of integration, ease of caregiver's commitment, the dedication of training, and companionship, all of which were shown to be essential in reducing the degree of abandonment.
5	Post, M., Leenders, J., Tepper, M., Snoek, G., van der Woude, L. and Adriaansen, J., 2019. Computer and internet use among people with long-standing spinal cord injury: a cross-sectional survey in the	Cross-sectional survey: Data used in this study were collected as part of the ALLRISC research program. Inclusion criteria	265 individuals living with SCI Community, The Netherlands	A total of 259 (97.7%) participants indicated to have Internet access. Of those with Internet access, 72.5% used a desktop computer to access the Internet, 59.6% a laptop, 35.1% a tablet and 37.7% a smartphone (more than one option possible).

	Netherlands. *Spinal Cord*, 57(5), pp.396-403. The Netherlands	were living with SCI for at least 10 years, between 18 and 35 years of age at the time of onset of the SCI, between 28 and 65 years of age at the time of inclusion in the study, and using a wheelchair, at least for longer distances (>500 m).		The most often used adaptive devices by participants with tetraplegia were a trackball (29.5%), a typing aid (20%), an adapted keyboard (11.4%), and speech-recognition software (11.4%).
6	Folan, A., Barclay, L., Cooper, C. and Robinson, M., 2015. Exploring the experience of clients with tetraplegia utilizing AT for computer access. *Disability and Rehabilitation: Assistive Technology*, 10(1), pp.46-52. Melbourne, Australia.	Qualitative methodology: A purposive sampling strategy was utilized to select participants who had experienced the phenomenon being investigated. Three main themes were identified.	Seven participants were recruited from the Victorian Spinal Cord Service (VSCS), Royal Talbot Rehabilitation Centre (RTRC), Melbourne, Australia.	The findings have demonstrated that people with tetraplegia can be assisted to return to previous life roles or engage in new roles through developing skills in the use of AT for computer access and can also make sense of their injury and altered abilities. Being able to use computers for meaningful activities contributed to the participants gaining an enhanced sense of self-efficacy, and thereby quality of life.

The search of the selected databases resulted in the retrieval of six papers and the Google search yielded no additional papers.

Quality appraisal of the literature listed in the summary table, was conducted. The quality of selected papers was assessed using the Critical Appraisal Skills Programme (CASP; 2019) tool, the systematic review checklist. JBI Critical Appraisal Checklist Tool for Qualitative Research (Lockwood, Munn and Porritt, 2015) and the Specialist Unit for Review (SURE; 2015) appraisal tool.

2.1.2. Occupational therapy and quadriplegic spinal cord injury

Occupational therapy treatment is described as the art and science of assisting individuals in conducting their daily activities. The aim is for the individual to improve their health and wellbeing through engagement in valued occupations (Crepeau et al., 2009). Moreover, Gallagher et al. (2015) state that health and wellbeing improve when individuals make purposeful and meaningful choices to complete everyday actions. Throughout history, the development and implementation of practice models in OT have been essential to its practice. In addition, OT compensatory creative treatment is defined as the art and science of aiding persons in conducting their daily tasks. Encouraging participation in meaningful occupations is a critical component in improving the health and wellbeing of patients (Crepeau et al., 2009). This is consistent with the findings of Gallagher et al. (2015), who determined that individuals' health and wellbeing increased when they could make purposeful and meaningful choices in their daily activities.

Mainly, the goal of OT interventions with QSCI patients is to assist patients who have not learned the necessary skills, have lost the skills, or are no longer adequately able to perform their daily activities (Kardatos, Evangelopoulos and Vlamis, 2021). As a result, occupational therapists should help QSCI patients in adapting their activities to align with their abilities (Kardatos, Evangelopoulos and Vlamis, 2021). Furthermore, entertainment and leisure activities have been demonstrated as incredibly useful for SCI patients, as they boost self-esteem and emotional expression and facilitate community reintegration (Lee and Nantais, 1996; Nas, 2015).

In the therapeutic process, occupational therapists play a vital role by maximising disabled persons' freedom and participation in their daily activities (Nas et al., 2015). The

World Health Organization defines disability as a physical impairment that limits one's capacity to carry out duties as competently as others of a similar age (WHO, 2014).

As mentioned previously, since a patient's health and wellbeing may affect their ability to feel pleasure, satisfaction, joy, comfort, solace, and balance (Law et al. 1998; Umberson and Karas Montez, 2010), occupational therapists find essential value in assisting patients with their health and wellbeing (Law et al. 1998; Stuckey and Nobel, 2010). Additionally, occupational therapists can reduce the number of restrictions to leisure activities that affect disabled patients by applying creative compensatory techniques to their interventions (American Journal of OT, 2017; Walter and Winston, 2018).

In conclusion, OT treatment is described as the art and science of assisting individuals with the conduct of their daily activities. Mainly, the goal of OT intervention with QSCI patients is to assist patients who have not learned the necessary skills (or have lost the skills needed) to conduct their daily activities. Thus, OT treatment is critical in improving the health and wellbeing of patients via encouraging their participation in meaningful occupations.

2.1.2.1 Occupational therapy and creativity

For nearly 50 years, the topic of creativity in OT has piqued curiosity and gained the attention of the scientific community (GILHOOLY, 2021). According to Hong and Song (2020), the production of a unique product or appropriate solution to an open-ended problem is the epitome of creativity. According to Hasselkus (2002), everyday creativity is a capability or quality present in all individuals (to varying degrees) that manifests itself in multiple aspects of daily life. Due to occupational therapists’ endorsement of this viewpoint, understanding the function of creativity in treatment has become a primary focus of occupational science (Cutchin et al. 2008).

Moreover, Akyurek et al. (2017) state that technology plays a significant role in our everyday lives and in OT. Consequently, technology can be employed to help clients improve their occupational performance and involvement (Smith, 2017). Thus, technology has become a crucial component of OT services (Akyurek et al., 2017). Actions that can be taken in the utilisation of AT include the following: evaluation of needs, selection of appropriate equipment, purchase of devices, and assistance from users (and other interested parties) in the process of adjusting to the device (Copley and Ziviani, 2004).

Désiron et al. (2011) emphasise that OT is a crucial component of the recovery process and that, in industrialised countries, rehabilitation teams typically provide OT treatment sessions for different disabilities. Nas (2015) and YoungStrom (2002) state that before and after an accident, OT is designed and performed based on an individual's social and cultural features, level of education, personality traits, interests, values, attitudes, and behaviours. As creativity is considered a critical component of how occupational therapists rehabilitate individuals successfully, one would expect to see it emphasised extensively in the OT literature; however, the contrary is true. Although creativity is considered a crucial factor, Blanche (2007) claims that the genuine experience of creativity is rarely addressed in the OT literature.

In general, overall OT intervention goals almost exclusively focus on improving QoL (Liddle and McKenna 2010). OT interventions are intended to positively affect patients' lives by encouraging participation in meaningful occupations, facilitating growth, and maximising human potential (Jackman 2014). The OT literature on QoL strongly advocates for creativity in practice and research, as treatment techniques are rarely used with aim to lengthen lives. Rather, they are used to enhance people’s lives.

As QoL relates to the actual functioning and satisfaction of the client at a participation level (i.e., social role), its focus is on factors that the client deems important. Therefore, a consideration of QoL may generate a tailored therapy that is highly relevant to a specific client, thereby facilitating an intensely person-centred approach (Liddle and McKenna 2010). In addition, Baron et al. (2019) argue that promoting health, wellbeing, and QoL could and should be included in every client's intervention plan because this is OT's essential role in healthcare. Thus, a far-reaching opportunity exists for OT research to be applied to improve people’s health, wellbeing, and QoL to help meet societal needs.

Additionally, the function of OT is to assess patients' strengths and limitations and plan relevant occupationally focused interventions accordingly. In individual cases, an OT treatment plan is developed and implemented depending on the individual’s social and cultural characteristics (e.g., level of education, personality traits, interests, values, attitudes, and behaviours both before and after injury; Nas 2015).

Furthermore, since the field's inception, creative techniques in OT have consistently demonstrated favourable effects on patients. Creativity helps in motivating individuals to pursue their interests (Freund and Holling 2008), and occupational therapists have a significant role in supporting patients' enthusiasm and engagement (Kielhofner, 1985; Creek, 2002). Moreover, based on his understanding of the requirements chain, Maslow (1968) proposed three categories of inventiveness: critical imagination with connective and psychological drives, optional inventiveness with vital and challenging work, and coordinated classification.

Additionally, creative endeavours can improve patients' self-esteem and experience of pleasure (La Cour et al. 2005) while also aiding in problem solving (Graham, 1983). Thus, integrating patients in activities that relate to their interests and incorporating creativity into their daily tasks may increase patients' sense of satisfaction (Atkinson and Wells 2000). In OT, creative problem solving is defined as deciphering a problem to understand it, generating ideas to solve the problem, and evaluating these ideas to locate the most effective solutions (Kim et al., 2019). It entails activities that people must do, are expected to accomplish, and want to complete (Hocking, 2009).

Notably, OT can reduce the number of restrictions to leisure activities affecting disabled patients through application of creative concepts (American Journal of OT 2017; Walter and Winston 2018). Moreover, according to Hasselkus (2002), everyday creativity is a capability or quality that exists to varying degrees in all people and manifests itself broadly in daily life. Consequently, wide acceptance and awareness of the role of creativity in OT have provoked a significant focus on how creativity can be utilised in the field of occupational science (Cutchin et al. 2008).

Although occupational therapists often underappreciate the importance of creativity in OT treatment, the concept of innovativeness is important in OT treatments for impaired people (Schmid 2004; Ernst and Moore 2013). Thus, according to Ernst and Moore (2013), for innovativeness to be adopted into everyday practice, its components require more explicit logical definitions.

2.1.3. Quadriplegic spinal cord injury and quality of life and wellbeing

Quality of life is a term used to evaluate individuals' wellbeing in various contexts. For patients with QSCI, achieving a satisfactory QoL is a primary goal of treatment and rehabilitation (Jackson et al. 2004). Additionally, meeting individual needs, controlling one's environment, and making choices have all been linked to a more beneficial QoL (Yasuda et al. 2002). Finally, when considering QoL, it is vital to acknowledge the components of psychological wellbeing (de Roon-Cassini et al. 2009) and psychosocial wellbeing.

Psychosocial well-being is a superordinate construct that includes emotional or psychological well-being, as well as social and collective well-being (Martikainen, Bartley and Lahelma, 2002). The term “quality of life” is similar to psychosocial well-being in that it involves emotional, social, and physical components (Slade, 2010). It is vital since studies have discovered that people with higher psychological well-being are more likely to live healthier and longer lives than people who lack this (Kubzansky et al., 2018). They are also more likely to enjoy a better more advantageous QoL.

Concerning individuals with an SCI, in addition to the physical, emotional, financial, and vocational limitations they may experience, they are also consistently challenged by secondary disorders, medical problems, and a low QoL (Peter et al. 2012; Yasuda et al. 2002). Furthermore, people who are Furthermore, people who are confronted with a complicated and significant life challenges, such as an SCI, can find their QoL to be, these challenges can severely impact an individual's QoL, particularly when it comes to concerning community reintegration (Yasuda et al. 2002).

Previous research has revealed that people with a QSCI have a lower QoL than the general population (Yasuda et al. 2002; Chapin and Holbert, 2010; Fadyl and McPherson, 2010; Frieden and Winnegar 2012; Peter et al. 2012; Kent and Dorstyn 2014).

Notably, QoL can be considered as a representative of a person's wellbeing concerning their capacity to seek life objectives (i.e., values to advance their physical life).

In this way, satisfying essential human needs is a critical component in achieving a high achieving a high QoL. Most studies exploring the life satisfaction of people with a QSCI have utilised a cross-sectional design and have measured participants’ life satisfaction many years after they acquired a QSCI (Post et al. 1998; Osteråker 2007). However, a longitudinal report with estimations one, two, four, and five years after the injury (Lobello 2004) indicated a slight improvement in life fulfilment within the first two years followed by an adjustment concerning how to adapt or become used to those new situations after SCI in subsequent years.

Furthermore, according to Hammell (2004b), QoL is a critical area of concern for health practitioners. It is recognised and used in health science as an index for assessing health status to minimise associated problems such as anxiety and depression. However, previous research has failed to locate a link between age and QoL in patients with a QSCI (Barker et al. 2008). This suggests that more research is needed regarding how and if age has an impact on QoL for people with a QSCI.

Although a significant body of research has explored QoL perceptions among people with a paraplegic SCI, there has been limited research that has aimed to determine whether people with a QSCI experience a high QoL a high or whether they perceive survival as a worthwhile experience (Hammell 2004b).

Notably, a variety of factors appear to impact QoL and wellbeing after a person’s diagnosis with a QSCI. According to qualitative studies with QSCI patients, certain determinants (e.g., having meaningful connections, exercising one’s abilities and principles, and having control over one’s everyday life) have been perceived as affecting and improving patients' wellbeing because these elements aid in the development of self-worth and self-sufficiency (Hammell 2007; Bergmark et al. 2008; Duggan et al. 2016; Clifton et al. 2018; Geard et al. 2018; Simpson et al. 2020).

Research has also been conducted on the role of the proposed modified PS4 DualShock controller on the QoL of individuals with various severity levels of quadriplegia. It has been established that individuals with C5 quadriplegia have functional use of elbow flexion. This level (Cervical spine level 5) has many symptoms, including the inability to control muscles that impact wrist extension and have difficulty grasping and holding an object while maintaining shoulder and arm movement (Raghavan, 2015). As a result, many of their daily tasks need adaptations like brushing their teeth, holding a spoon, and holding a pen with the help of specialized assistive devices (such as wrist or hand orthotics to allow them to hold objects), these individuals can achieve independence in feeding and grooming (Ferreira et al., 2018). Additional research by Mateo et al. (2015) also shows that individuals with C6 quadriplegia have the added function of wrist extension. This permits tenodesis, or passive thumb adduction on the index finger during active wrist extension, which assists with grasp and release (Mateo et al., 2015). Nonetheless, it was anticipated that both C5 and C6 QSCI would be able to use the PS4 DualShock Controller modification since the arm movements are intact by pushing the triggers outward and forward (Tsai et al., 2014) in order to be able to press the rear buttons which is the main concern for the gamers of QSCI patients.

According to some studies, neither the degree of impairment nor the degree of the disability can be used to accurately measure a patient's satisfaction with their QoL following a QSCI (Kemp et al., 2014; Kunz et al., 2021). Finally, occupational therapists may need to utilise a more client-centred approach to treatment, through which assessment, intervention, and outcome measurements are thoughtfully conducted with consideration of the individual’s subjective viewpoints. This approach allows therapists to better grasp what QoL means to each individual client.

In conclusion, QoL is a term used to evaluate individuals' wellbeing in various contexts. People with a higher QoL are more likely to live healthier and longer lives (Kubzansky et al., 2018). Previous research has found no link between age and QoL in patients with a QSCI. This suggests that more research is required regarding how and if age has an impact on QoL for individuals with a QSCI. It can also be beneficial for occupational therapists to exercise a client-centred approach to treatment.

2.1.3.1 Leisure repertoire among persons with quadriplegic spinal cord injuries

People engage in leisure activities to socialise, relax, or pursue interests and hobbies. In this regard, such activities can be enjoyed and freely selected by the individual. Generally, each person has a repertoire of leisure activities that they enjoy and engage in regularly (Mobily, Lemke, and Gisin 1991). However, after a QSCI, people may experience disrupted living patterns that instigate changes to their leisure repertoire, regardless of the localisation of the injury or the time that has passed since the injury occurred (Lundström et al., 2013). Correspondingly, such a leisure activity modification could present itself as a change in the hours spent on leisure or as a change in accessibility when performing certain leisure activities. Consequently, according to Lundström et al. (2013), such changes affect one’s wellbeing. Additionally, people living with a QSCI are prone to developing secondary health conditions, which also impact leisure time and productivity (Folan et al. 2015).

Some previous studies concerning people with an SCI have focused on the reasons why individuals have difficulty conducting leisure activities. These research studies typically describe the personal and environmental factors that provoke people's difficulties in performing leisure activities. Thus, the research generally implies that an absence or deficit of the skills required to conduct certain leisure activities can generate negative attitudes about life after an injury (Ekelman et al. 2016).

Therefore, developing the skills needed to effectively manage one's chosen leisure activities is critical in the community reintegration process, particularly for those at risk of poor social and psychological adjustment after injury. Although leisure activities may contribute to positive wellbeing among individuals with a QSCI, a lack of understanding concerning such activities that occupational therapists and their clients lack direction in selecting alternatives to a chosen to a chosen activity and in in designing leisure interventions (Loy, Dattilo, and Kleiber 2003).

Notably, active engagement in life (e.g., social activities and friendships) and satisfaction concerning how one's time is spent in leisure and recreation have been associated with subjective wellbeing following a QSCI (Kuykendall et al. 2015). While studies have demonstrated the importance of leisure in adjusting to a QSCI, they have not differentiated between the qualities or components of leisure experiences that influence adjustment. Furthermore, they have not outlined. Furthermore, they have not outlined the processes by which leisure engagement changes over time (Loy, Dattilo, and Kleiber 2003).

In addition, sentiments of reliance on others, limited social supports and suitable assistance, and negative societal views about individuals with a QSCI have been identified as barriers to participating in leisure activities for people with a QSCI (Isaksson et al. 2007). Nevertheless, according to Beringer (2004), people with a QSCI spend significantly more time each day on leisure activities than people without a disability. These leisure activities include an overrepresentation of sedentary activities (e.g., listening to music, watching TV, reading, and engaging in computer-based activities). Likewise, according to reports, people with a QSCI can feel dissatisfied and bored with everyday life if they cannot obtain an optimal degree of wellbeing. This is because they are unhappy with their current situation (Lee and Mittelstaedt, 2004).

2.1.4. Psychological impact after quadriplegic spinal cord injury

Even though the findings mentioned above highlight the role of leisure activities in a person's QoL, some impediments to progress are also identified. Isaksson et al. (2007) mention feelings of reliance on others, a lack of social support, a lack of suitable assistance, and negative societal views about individuals with QSCI as barriers to participating in leisure activities. Apart from these challenges, adjusting to a QSCI or a physical disability is a life-long process (Nas, 2015) that leads to emotional and behavioral issues (Chan et al., 2014). As a person tries to reconfigure their life, they are faced with sadness, anxiety, and clinical depression (Lim et al., 2017). Disability-related psychological difficulties relate to rehabilitation complications, lower QoL, delayed recovery, and increased secondary medical problems (Park, 2019). Furthermore, disability is frequently associated with negative emotions such as loss, helplessness, and depression (Miller and Dishon, 2006). However, not all people with impairments have psychological issues. Many people effectively adjust to life's major upheavals, such as bodily harm.

In contrast, depression includes more prolonged and debilitating thoughts and emotions (for example, helplessness, hopelessness, personal worthlessness, excessive guilt, thoughts of suicide) and changes in vital processes (e.g., disturbances in appetite, sleep, and energy; Umlau, 1992). By addressing these psychological challenges, OT enables QSCI patients to be more social, use their functions for creative tasks, and deal with psychological issues such as depression (Loy, Dattilo, and Kleiber 2003). Furthermore, daily activity adaptations are necessary for people with QSCI to perform everyday activities independently. For example, for this research, an adapted and modified PS4 DualShock Controller has been proposed for use by an OT for people with QSCI to use.

Acceptance of disability has been proposed by researchers as one factor that explains why this varied variety of adaptations develops (Livneh, 2001). Acceptance of disability is also used in the context of disability adaption (Keany and Glueckauf, 1993). Acceptance of disability is considered as being strongly related to acceptance of loss (Park, 2019). According to Nas (2015), depression is not a natural process experienced after QSCI. However, it is a complication that needs to be treated. Therefore, occupational therapists must focus on a patient's mental well-being to restore the person's psychological and emotional state because of the high incidence of depression in patients (about one-third in the first six months; Burcusa and Iacono, 2007). Other effects, such as grief, may be exhibited by expectable feelings of sadness, loss, and longing for the past. Acceptance of disability has been defined as acceptance of loss and explained from the standpoint of viewing oneself as "other than ability" (Nicholls et al., 2011). Furthermore, acceptance of disability is likely to be connected with greater disability adjustment.

In Loy et al.'s (2003) study, the research objective was well-articulated, and the study addressed the critical areas of the JBI quantitative design focus. Three research questions were used to formulate the hypothesis for the study investigating the role of leisure activities on QoL. The questions included whether leisure activities have an impact on the adjustment of persons with SCI if participation in leisure activities has an impact on adjustment and what the effects are, and finally, whether social support has a role in mediating the impact of leisure on the adjustment of people with SCI. The statistical findings were relevant to the study and applicable to the topic. The main limitation is that the findings on participation in leisure activities impact on adjustment of persons with spinal cord injury lack generalizability.

The critical appraisal skills program (CASP; 2019) assessed Nas's (2015) systematic review. The aim was to establish the results, validity, and application locally. The review addressed a clearly defined question: the role of rehabilitation in restoring functionality in persons with spinal cord injuries. The sources used in the study were relevant to the research question and provided information pertinent to the topic. However, all the important and relevant studies were not included in the paper, with no clear indication of the bibliography databases used or follow-up reference lists. Regarding the assessment of quality, it is difficult to tell if the authors did a thorough evaluation because the methodology section is not clearly defined. The results were provided separately according to each study's findings. The overall results indicated the importance of rehabilitation in various SCI injury levels and the need for early intervention for restoring autonomy and functional abilities. The precision of the results is not provided and, therefore, cannot be determined from the section. The results cannot be applied to a local population due to insufficient evidence to support the interventions. All the critical outcomes like the impact of rehabilitative measures on a patient's involvement in leisure activities were not mentioned. The technological outcomes were also not discussed. Based on the CASP analysis, the researcher believes the benefits are worth the harms and costs, if any, because there are several benefits of the proposed interventions which may significantly improve the QoL of SCI patients.

To conclude, emotional and behavioral issues may also arise or worsen following a QSCI. Sadness or anxiety may arise from time to time. There is a need for therapists to address these mental issues to achieve improved QoL. Patients who receive the appropriate treatment for the conditions fare better socially and emotionally and can engage in leisure activities more frequently than their unattended counterparts. After this has been achieved, this research proposes implementing an adapted and modified PS4 DualShock Controller as an OT intervention for people with QSCIs.

2.1.5. Quadriplegic spinal cord injury and assistive technology

A relationship has been established between a reduced ability to execute valued daily tasks and a loss of self-worth (Hammell, 2006). These studies have been critical in understanding the impact of SCI on patients' well-being.

Further research was conducted on the topic, investigating the role of AT in enhancing a patient's quality of life. The pool of selected articles included two systematic reviews: the first on the impact of AT on QoL measures for people with QSCI (Baldassin et al., 2018), and the second on its effect on communication abilities for people with cerebral palsy (Nerisanu et al. 2017). Both systematic reviews found that devices and software that allow users to conduct functional tasks improved their QoL, although neither examined specific devices (Nerisanu et al., 2017). Additionally, according to the researchers (Folan et al., 2015; Hooper et al. 2018; Verdonck et al., 2018), using AT soon after a QSCI can help increase involvement in meaningful jobs, valued responsibilities, and the independence needed to remain alone for prolonged periods. Technology plays a vital role in managing the condition, with internet access being linked to improved QoL for people with QSCI using a modified computer (Houlihan et al., 2003). A modified computer necessitates new interfaces that compensate for the loss of body functions by using other available input sources for control (Caltenco et al., 2012).

Baldassin et al.'s (2018) research was also evaluated using the SURE appraisal tool. Similarly, in terms of the setting, approach, intervention, and assessment, the research addressed a clearly defined hypothesis. The study aimed to identify and organize evidence regarding how the QoL is influenced by computerized AT for people who have suffered traumatic or non-traumatic SCI. The location was the Brazilian state of Distrito Federal. The sampling technique and data collection criteria were clearly outlined. A search method was developed and implemented on PubMed, LILACS, PsycINFO, and SCIELO. All sorts of research designs that looked at how AT may enhance the QoL for people with spinal cord injuries were considered. The review findings were credible and relevant to the research question indicating that devices enabling computer access to enhance the QoL of persons with SCI, independent of the severity of the disability or the kind of resource available. One of the limitations was that due to a lack of research and a variety of study designs, it is difficult to make conclusions about the usefulness of assistive devices for computers in the lives of persons with SCI due to a shortage in similar studies. Moreover, scientific evidence and generalizability have been compromised by the weak methodological quality of the studies.

The SURE appraisal tool evaluated Nerisanu et al.'s (2017) article. In terms of the setting, perspective, intervention, and evaluation, the study addressed a focused question/hypothesis. The qualitative method was s systematic review, appropriate for studying the topic. The data collection strategy involved several online resources, and journals were used as the materials for the research. The findings established a significant influence of AT on cerebral palsy patients, including the level of integration, ease of caregiver's commitment, the dedication of training, and companionship, all of which were shown to be essential in reducing the degree of abandonment. These results were credible and relevant to the research topic, showing the impact of technology on the target population. The main limitation was the affordability of the recommended technology. Low-cost eye-trackers had deficiencies in accuracy. Moreover, the level of engagement and support from qualified staff, instructors, parents, caregivers, and patients is also a constraint, which causes a disparity in achieving the greatest possible outcome for those who need it the most.

Additional technological benefits have also been experienced in practice. According to a recent study conducted in the Netherlands (Post et al., 2019), people with tetraplegia used one or more assistive devices (most of which involved typing help or trackballs) to use their computers. An earlier study indicated that mastering AT for computer use had positive benefits and assisted patients in overcoming physical barriers and coming to terms with a new way of living (Folan et al., 2015). Many participants reported that using a computer empowered them and gave them a sense of control over their lives, helping patients to feel 'better' about their condition could, in turn, lead to a way of coping with their injury.

In addition, AT also improved a disabled person's capacity to participate in meaningful occupations by enabling easier access to their devices (Reitz, Scaffa and Dorsey, 2020). Increased access leads to increased involvement in occupations. AT helped people reduce social isolation and improve their capacity to interact freely (Folan et al., 2015; Baldassin et al., 2018; Hooper et al., 2018; Verdonck et al., 2018; Mortenson et al., 2019). These advantages have been demonstrated in areas where technology is adopted in QSCI therapy. For instance, the value of AT in improving QoL and reintegrating people with QSCI into their social activities has been well documented in international studies. The benefits span across various dimensions, including promoting functional independence and improving patients' depressive symptoms (Folan et al., 2015; Khazaeipour et al., 2015)

The SURE appraisal tool was used to evaluate the studies (Folan et al., 2015; Post et al., 2019) used in this literature review section. The hypotheses were focused on the research question investigating the experiences of tetraplegia patients and the role of computerized technology in enhancing leisure activities. The study designs were qualitative and relevant to the type of research being conducted since the aim was to collect user experiences. Various ethical issues were considered, including informed consent and confidentiality. The SURE appraisal tool for both studies found the findings to be credible and reliable for application. It was determined that through assistive computer technology, persons with tetraplegia might be aided in returning to prior life roles and developing new meaningful roles (Folan et al., 2015; Post et al., 2019). Participants' increased feeling of control over their life was aided by their ability to utilize the internet to interact and carry out everyday chores. Early initiation to AT is critical to ensuring that newly wounded persons have enough time to get familiar enough with the technology to use computers effectively by the time they are discharged. Therefore, the findings were credible and significantly contributed to the topic.

2.1.6. Gaming and quadriplegic spinal cord injury

As stated by Lundström et al. (2013), many leisure activities could positively impact the QoL of QSCI patients. Video gaming is a prevalent leisure-time activity with more than two billion participants worldwide (Newzoo, 2017) and is considered the most popular leisure activity among people with QSCI (Pew Research Centre, 2018). It is critical to provide definitions to better understand the research problem when analyzing this component. Esposito (2005) defines video games as recreation activities based on a story using audio-visual apparatus. In recent years, the body of scientific research devoted to video game playing has increased (Hamari and Keronen, 2017). These studies have provided findings that suggest playing games may have therapeutic benefits (von der Heiden et al., 2019).

Various scholars have researched the clinical application of games on diverse patient populations. According to 2021 demographics analysis, the average age of video game players has increased, with 38% of video participants aged 18 to 34 years old (which is the age of most QSCI patients (Player Diversity and Demographics - Ukie, 2022), while 6% are 65 years old and above (Entertainment Software Association, 2021). Arguably, therefore, as younger generations have experienced video games as a normal part of life, this type of gaming is no longer a hobby exclusively enjoyed by the young.

However, despite the need for an innovative and effective rehabilitation protocol among QSCI, no known comprehensive review has specifically addressed the effectiveness of video gaming on rehabilitative outcomes or how it might affect QoL for people with disabilities. (Zeng et al., 2017). Interestingly, two non-experimental studies have suggested that video gaming could be an effective rehabilitative tool in improving QoL but not to such a degree that it might significantly trigger mood changes (Herz et al., 2013; Mhatre et al. 2013). In the article “A systematic review of active video games (AVG) on rehabilitative outcomes among older patients”, Zeng et al. (2017) examined the impact of the effectiveness of AVG-based rehabilitation among older adults with chronic illnesses and/or physical. The article further contributes and ideas for propose future research directions in research this area and regarding appropriate rehabilitation settings. Significant results were noted in the results of this study, but there are limitations in applying these findings to this study. First, while this article produced significant results showing the effectiveness of AVG-based interventions on older patients' rehabilitative outcomes, nine studies found significant improvements for all the outcome measures investigated, such as functional ability, balance confidence, and cognitive performance. However, it did not measure the QoL or effects on

SCI. Secondly, the variety of AVGs employed in the study limited the ability to discern which specific games, and which aspects of those games, are most useful for the rehabilitation of specific diseases and/or impairments. Finally, this study does not evaluate the impact of video gaming on the age group of young adults or QSCI individuals.

Since there is a gap in studies regarding how OT creative adaptations could benefit the modifications of such devices, this research is conducted to describe how a modified PS4 DualShock Controller affects the QoL and well-being of people with QSCI. The findings indicate assistive devices can be used for support, therapy, and cosmetic purposes. Moreover, they can be designed for users to achieve a level of performance that would otherwise be impossible to accomplish.

2.2 Research Gap

Based on the literature covered in this study, there are some research gaps. Concerning the desire for a novel or successful rehabilitation approach among people with QSCI, no comprehensive evaluation of video gaming on rehabilitative results or how it might affect QoL for this population (Zeng et al. 2017) has yet been performed.

Moreover, the investigation of the literature for this paper revealed no research in Saudi Arabia on the factors that influence disability acceptability in QSCI patients.

As an OT, there is a need to comprehend how a use of adaptations might contribute to QoL for people with disabilities. This relates to how devices and gadgets can be modified and adapted so that QSCI patients can use them – and have the same chance at gaming as someone who is able-bodied.

Following these findings, there is a need for additional studies investigating the integration of adaptive technologies to support people with disabilities for improved functionalities, restored autonomy, and improved QoL. The topic is important in practice because, as mentioned above, disability can have an emotional and psychological impact on a person when they realize that they unable pursue the hobbies they used to enjoy as a leisure activity. Consequently, their QoL and overall well-being may suffer. Therefore, the review section shows the need for implementing a modified PS4 DualShock Controller to impact the QoL and well-being of people with QSCI.

3. CHAPTER THREE

3.1. Methodology

This methodology chapter provides a detailed description of the process followed for this study (with justification for the steps taken provided in each section). The first section describes the rationale for adopting a qualitative research methodology, emphasising the qualitative descriptive (QD) approach. Then, the data collection and analysis procedures are explained (with supporting evidence). Following this, ethical considerations relevant to this study are outlined, and a clear explanation is provided about steps taken to ensure trustworthiness in the study outcomes. Finally, information concerning ethical approval and funding considerations for this study is provided.

3.2. Research Design

3.2.1. Qualitative research

A researcher's methodology (e.g., qualitative, quantitative, or mixed methods; Lewis, 2015) is determined through consideration of the research question and the researcher's aims, which may be influenced by the philosophical and theoretical viewpoints of the researcher (Holloway and Wheeler 2010; Ormston et al. 2014). The research aims of this study are (a) to consider the subjective experiences of QSCI participants regarding how QoL and wellbeing were affected after their injury, (b) to examine how the modified DualShock controller has influenced participants' QoL and wellbeing, and (c) to investigate whether the modified DualShock controller provided participants with the confidence and motivation to consider pre-injury and post-injury meaningful activities.

Concerning research that is focused on the social world and subjective experiences, Dew (2007) recommends qualitative inquiry as the most advantageous approach in investigating subjective experiences. Therefore, for the purpose of this study, a qualitative design has been chosen to address the project’s aims. This is an exploratory study (McReynolds et al., 2001) that aims to examine how the modified PS4 DualShock controller created by an occupational therapist influences QoL experiences for patients in a rehabilitation hospital in Riyadh, Saudi Arabia.

Qualitative explanatory designs are employed to explore the social world through participants' lived experiences and to consider the meaning of their experiences (Astin and Long 2014), and this study has applied a qualitative explanatory design. Rather than attempting to fit researcher-selected dimensions of participants' experiences into existing theoretical frameworks or measurement instruments.

Furthermore, qualitative explanatory designs are characterised by an incorporation of meanings, concepts, definitions, metaphors, symbols, and descriptions of things (Berg and Howard 2012). Use of qualitative explanatory methods can contribute to health services and can be used to determine what is most important to patients and how their experience might be improved and add to the health policy research, especially in managing rapid changes and aiding in the development of a more fully integrated theory base and research agenda (Sofaer 1999). As a result, a qualitative explanatory design was employed to meet this study's aims.

Because the aim of this study has not been to assess the frequency or intensity of events, explain causal linkages, or prove a hypothesis, quantitative methodology was deemed inappropriate (Dew 2007; Holloway and Wheeler 2010). Additionally, qualitative researchers typically present the findings of their research to other prospective researchers. They do not aim for generalisations because qualitative researchers recognise the uniqueness of each research context and do not claim their study sample as representative (Bloomberg and Volpe 2012). Additionally, data in the form of experiential narratives or words, rather than numerical and statistical data, are targeted (Frank and Polkinghorne 2010).

Moreover, semi-structured interviews gather subjective responses regarding a particular situation or phenomenon that participants have experienced (McIntosh and Morse 2015). Such interviews are commonly used in qualitative research and represent the most frequent qualitative data source used in health services literature (DeJonckheere and Vaughn 2019). Thus, the overall purpose of using semi-structured interviews for data collection in this study has been to gather information from QSCI participants whose experiences, perceptions, and beliefs are relevant to the use of a modified DualShock controller device (Bradley, 2019).

3.2.2. Adopting a qualitative descriptive approach

The abundance of possible qualitative research approaches can confuse researchers when selecting the most suitable approach for their specific research topic (Cruz and Tanita 2017). Since the main purpose of the current study is to examine and better understand a phenomenon about which little is known, a QD method was adopted to obtain straightforward but rich descriptions of perspectives shared by relevant participants (Seixas et al. 2017). A QD approach is commonly used in OT to positively influence medical interventions (Kim et al. 2017).

Despite the relevance of a QD approach in healthcare studies, it is lesser known than other qualitative approaches, particularly to novice researchers (Andersen 2010; Stanley and Nayar 2014); thus, they can be deterred from using it (Lambert and Lambert 2012). However, Magilvy et al. (2009) assert that this approach may be an optimal choice for novice healthcare researchers because it allows for use of various sampling techniques, data collection strategies, and theoretical approaches while not being aligned with a specific philosophical positioning – as would be the case in the grounded theory approach, for example (Colorafi and Evans 2016).

Although the QD method is among the least theoretical of qualitative methods (Sandelowski 2000; Bradshaw 2017), it is driven by natural inquiry which, in turn, directs the researcher to study a phenomenon in its natural state. However, this approach has been criticised because it involves less interpretation than other qualitative approaches (Sandelowski 2000). Nevertheless, it might also reduce bias (which is a common criticism concerning qualitative research), as it focuses on presenting facts about the research topic, while personal opinions of the researcher are minimised (Hammarberg et al. 2016).

3.3. Data Collection

3.3.1. Sampling and recruitment strategy

Adopting an appropriate sampling strategy that suits the research inquiry is crucial when using qualitative methodology (Holloway and Wheeler 2010). Parahoo (2014) states that non-probability sampling is best matched with qualitative research. Since the researcher seeks a strategically chosen sample, generalizability is more of a theoretical or conceptual problem, and it is not viable to generalize back to the population (Palys and Atchison, 2014). This study adopted purposeful sampling, which is a type of non-probability sampling that does not require underlying theories (Etikan et al. 2016) and represents a more suitable method to use with the QD approach when compared with other non-probability sampling methods (Bradshaw et al. 2017). In purposeful sampling, participants are recruited based on certain merits such as who will offer an advantageous perspective regarding the inquiry through providing rich data (Sandelowski 2000; Lambert and Lambert 2012; Etikan et al. 2016).

Notably, qualitative researchers investigate participants' opinions, perspectives, and feelings concerning a phenomenon, which cover areas beyond addressing the study question (Ivey 2012). Additionally, in qualitative research, small sample size is viewed as a restriction (Anderson 2010; Hammarberg et al. 2016). However, Cruz and Tantita (2017) suggested that the number of participants is less important than who they are and what they contribute. Moreover, Morse (1994) suggests the need for approximately six individuals, whereas Creswell (2013) proposes using up to ten individuals.

Therefore, it was agreed to recruit seven participants for the current study. Although a small sample size implies that results cannot be generalised, this is not generally the goal of qualitative research (Rees 1996). Instead, the fundamental goal is to identify people's experiences to recognise and address a research issue. Furthermore, this researcher used a homogenous sampling strategy to find participants with similar features, such as diagnosis (Etikan et al. 2016). Participants were chosen for this study based on their diagnoses and gaming interests. Additionally, Holloway and Wheeler (2017) state that the average number of participants in homogeneous sampling should be between six to eight. This supports the decision to include a total of seven participants in this study.

As a result, inclusion and exclusion criteria for participants **(Table 4)** in this study were determined via considering the study's aim to gain rich, in-depth data from QSCI patients regarding use of a modified PS4 DualShock controller for video gaming.

Table 4 Inclusion and exclusion criteria for recruiting participants

Inclusion criteria	**Exclusion criteria**
Adults with a QSCI, aged 18 years and older	Adults who fulfil the inclusion criteria but who are in the acute post-SCI stage
Men and women who have an interest in playing PS4, which is determined through verbally asking them	Adults who fulfil the inclusion criteria but do not wish to take part
Spinal cord injury patients who are in the rehabilitation phase	Adults who have any kind of infection

Recruitment of participants began when the hospital's institutional review board provided its approval to move forward with the study **(Appendix 1).** The OT team supervisor from one hospital in Saudi Arabia recruited participants with consideration of the inclusion and exclusion criteria **(Table 4).** Potential participants were approached with an invitation letter **(Appendix 2).** and a summary of the intended research. Patients who express interest in the study were provided with a participant information sheet **(Appendix 3).** via the OT team supervisor (on behalf of the researcher). If patients wanted to participate after reading the participant information sheet, they contacted the researcher by email.

3.3.2. Participants

A total of seven QSCI patients (six males and one female) voluntarily consented to participate in the study **(Table 5).** The youngest was 18 years old, and the oldest was 45 years old. The participants were mainly affected by C6 injuries; two were affected by C5 injuries.

Table 5 Demographics of participants

Name of participant (pseudonyms)	**GENDER**	**AGE**	**LEVEL OF INJURY**	**INJURY EVENT**	**YEARS SINCE INJURY**
SALEM	MALE	32	C5	2011	10
ABDULAZIZ	MALE	19	C6	2019	3
FAISAL	MALE	29	C6	2010	11
ABDULHAFETH	MALE	18	C6	2018	4
MOHAMMED	MALE	22	C6	2020	1
KHALIFAH	MALE	45	C5	2007	14
FATEN	FEMALE	26	C6	2016	6

3.3.3. Interview method

In health-related research, individual interviews are commonly conducted to understand patients' situations and lived experiences (Bloom and Crabtree 2006; Nicholls 2017). Therefore, individual face-to-face semi-structured interviews were conducted for this study. Although interviews can be conducted in both individual and group settings (Bloom and Crabtree 2006), individual interviews enable participants to share their thoughts, opinions, and experiences without significant reluctance; this is unlikely to occur for every participant in a group interview (Qu and Dumay 2011; Bolderstone 2012).

The face-to-face interview method was used to elicit information from the participants (Bloom and Crabtree 2006). Additionally, Ryan et al. (2009) reported that this method allows researchers to better interpret non-verbal cues, adding to the study's trustworthiness. Thus, participants' facial expressions and body language were observed to help the researcher understand what was being said. Moreover, a semi-structured interview approach was adopted for this study. This approach represents the primary source of data collection in QD (Neergaard et al. 2009; Stanley and Nayar 2014) and allows for flexible communication with participants through constructing open-ended questions (Anyan 2013; Magnusson and Marecek 2015).

Furthermore, interview lengths vary depending on the research topic and the participants involved (Holloway and Wheeler 2017). However, an average of 20 to 60 minutes is considered an appropriate length for semi-structured interviews (Gill et al. 2008; Adams, 2015). This guideline was adhered to in the present study (with approximately 15 to 20 minute interviews conducted with each patient).

However, unlike structured interviews, which employ an interview schedule involving pre-selected questions that must be adhered to, interview guides in semi-structured interviews allow for less strict adherence to questions (Ryan et al. 2009), and new questions to emerge in response to participants' answers (Brinkmann 2014). Due to the nature of semi-structured open-ended questions, an interview guide **(Appendix 4).** was used to avoid limiting the responses and to encourage participants to freely express their thoughts (Sandelowski 2000; Qu and Dumay 2011).

This interview guide outlined elements to be covered during the interview. As Magnusson and Marecek (2015) recommend, the author’s supervisor revised the interview guide, and a pilot interview was undertaken. It included questions that allowed participants to add to what they had previously said and to ask further questions about the study.

3.3.4. Conducting the interviews and pilot testing

The semi-structured interview method chosen for this study permits use of an interview guide **(Appendix 4)** to lead the sessions. The guide is used to assist in focusing the conversation on the phenomenon of interest (Holloway and Wheeler 2010). McNamara (2009), Magnusson and Marecek (2015), and Doody and Noonan (2016) were considered as baseline examples of how to conduct the interviews.

The interview guide was reviewed, and pilot tested by the researcher's supervisor prior to the sessions. Hennink et al. (2011) urge that researchers perform a pilot interview with people who share the same characteristics as the actual respondents but are not part of the study population to ensure that the interview questions are understandable. As a result, a pilot interview was done with a person known to the current researcher who has worked for many years as a healthcare professional and as an OT team leader. As a beginner researcher, the supervisor's input and the pilot session experience aided this researcher in becoming acquainted with the guide and improving the interview questions and probes. The pilot session also prompted reflections from the researcher concerning interviewing skills (Holloway and Wheeler 2010; Jacob and Furgerson 2012). Information gained through the pilot interview was not included as part of data.

Following the OT team supervisor's identification of people who had consented to participate, a suitable time that would not interfere with their schedule was determined and agreed upon via email for each participant. The interview location was chosen for its convenience, seclusion, and tranquillity. The participants were interviewed in a reserved room in the hospital to ensure their comfort (and that the audio recordings were sufficiently clear). The rooms were reserved for two hours to avoid inconvenience if interviews took longer than expected. A tape recorder was placed close to where participants would be sitting (but out of their view) so that recording could proceed without interruption.

The researcher welcomed the participants at the start of the interview and thanked them for agreeing to participate in the study. The researcher introduced herself, explained the study's goal and the expected length of the interview, and requested permission to use a tape recorder. General and demographic questions followed this. Participants were assured of confidentiality. They were informed that they could ask questions during the interview and had the option to pause the session to take a short break.

The interviews went smoothly with participants discussing the topics that needed to be explored for the study. The interview started with the central question: “Thinking about your experience with a QSCI, can you please tell me if you have problems in your daily life because of the QSCI? If so, how have they affected your QoL and wellbeing?” This question was asked to help the participants feel at ease, as they were asked to describe something familiar to them (White 2008). During the interview, the researcher listened intently and followed up on the participants' comments without interrupting them to create a welcoming environment, where they could feel free to provide detailed descriptions of their life experiences after a QSCI (DeJonckheere and Vaughn, 2019)

The number of probing questions differed among participants. Notably, one participant required many probing questions, whereas other participants quickly comprehended what the study aimed to examine; hence, probing differed from one individual to the next. Furthermore, the researcher utilised probing questions with caution to avoid leading the participants or making them feel obliged to provide a specific response (King and Horrocks 2010). After the data collection was complete, a debrief sheet was provided to each participant **(Appendix 5).**

3.3.5 Transcription

Transcription transforms a verbal interaction into written words (Meredith, 2015). With participants' prior consent, audio recordings of the interviews were transcribed verbatim and sent to participants so that they could review the text and make amendments (if necessary) before the data analysis was conducted. While the non-verbal interactions of participants were also observed in this study to assist with data analysis and add meaning to the data (Ryan et al. 2009), only verbal data were analysed due to the word limit of this study. According to (Hammersley, 2010) transcribing the acquired data would increase the rigour of the study because verbal communication is more precise when recorded in words. However, according to Nikander (2008), the translation of the language spoken during the interviews into another language in the transcripts may result in a loss of meaning of the data acquired. As a result, because the interviews were conducted in Arabic, the transcripts were only partially translated into English, with only chosen quotes and relevant material translated. However, for the sake of illustration, one transcript has been fully transcribed into English **(Appendix 6).**

3.4. Data Analysis

The QD approach does not rely on a pre-existing theoretical framework or pre-existing rules for data analysis (Neergaard et al. 2009). Instead, thematic analysis (TA) was utilised as a practical method to report the participants' experience, meaning, and reality (Folan et al., 2015). Thematic analysis is a method that provides an understanding of the text by identifying themes and providing a detailed description (Crowe et al. 2015; Neuendorf 2019). When locating themes, the goal is not to measure the prevalence of elements in the dataset but rather to elicit the most important elements related to the research questions (Braun and Clark 2006). Moreover, during data gathering and before analysis, all interviews were audio-recorded – with participants' informed consent – and subsequently transcribed. Words and sentences spoken in Arabic were translated into English by the author. Trustworthiness issues pertaining to translating transcripts were addressed via member checking, which is further discussed in Section 3.6.

To aid analysis and presentations of findings, Braun and Clarke's (2006) TA was utilised as a framework for this study. This choice is based on several factors. First, it can provide the researcher with an understanding of an event based on the experiences of various research participants regarding a novel research topic (Braun and Clarke 2006). This is appropriate for the current study, as no previous studies have explored the therapeutic use of a modified DualShock controller device for QSCI patients.

Second, TA best suits the QD approach, meaning that it does not follow a particular theoretical framework, which promotes a flexible method of analysis (Braun and Clarke 2006; Maguire and Delahunt 2017). Additionally, Vaismoradi et al. (2013) assert that most qualitative analysis is essentially thematic while also arguing that TA should be viewed as an independent and reliable method in its own right.

Furthermore, according to Braun and Clark (2006), TA can be inductive or deductive: deductive analyses are driven by testing the empirical literature, whereas inductive analyses are data-driven as few or no previous studies have addressed the same phenomenon. Thus, preference was given to the inductive approach because no previous studies have considered this research topic. However, Vaismoradi et al. (2013) suggest that themes should be identified through both the manifest level of surface meaning and the latent level of underlying ideas.

In Braun and Clark's (2006) article, they explain six phases of TA **(Table 6),** which were utilised by the researcher. Several considerations influenced the decision to choose the TA technique. For starters, this approach provides a knowledge of a new study topic's perspective from numerous participants (Braun and Clarke 2006). This is especially true when it comes to the current study because the factors influencing the QoL and wellbeing of QSCI individuals after experiencing modified DualShock controller have never been studied before. Second, because the researcher is new to the subject of research, it is suggested that TA be utilized to offer the skills required to undertake various formats of qualitative analysis (Vaismoradi et al. 2013). Third, because TA does not adhere to a certain methodology and promotes a flexible manner of analysis, it appears to best match the QD strategy utilized in this project (Maguire and Smith, 2017). The TA of this investigation was inductive, as advised by Braun and Clark (2006), which means that the analysis was more likely data-driven due to the scarcity of papers that addressed the same research issue. Themes were discovered by looking at both the visible level of surface meaning and the latent level of underlying thoughts (Vaismoradi et al. 2013).

Additionally, it is important to note that the TA in this study was conducted manually by the researcher rather than through a computer program. According to Van Manon (2014), the application of computer analysis to qualitative data becomes mechanical and quantitative through the counting of terms, codes, or phrases. Additionally, the meaning of the subjects' lived experiences was determined in a complex and relevant manner through researcher-based data analysis, which allows for flexibility in analysis.

Initially, interview transcripts were read and reread to gain familiarity with data. Codes were then highlighted across transcripts, and similar codes were grouped together into overarching themes. Themes were reviewed and redefined, and quotes from original transcripts were selected to represent findings. Moreover, data are organised and analysed by categorising data into domains and defining taxonomies or themes. Thus, the data become more accessible. The development of themes from the data aids in organising the dialogue, behaviours, and activities into areas for future research and discussion (Chun Tie, Birks and Francis, 2019).

It is important to recognise that themes emerge from the data through the appearance of concepts that originate from the data rather than issues imposed or recognised by the researcher. Once a theme has appeared, the researcher seeks evidence to support the emerging theme in other data (De Santis and Ugarriza, 2000). Furthermore, according to De Santis and Ugarriza (2000), themes occur in a hierarchical order, ranging from broad to specific. Category is the first level of organisation in thematic creation, and it is the lowest level of data analysis, unifying one or more ideas or data pieces.

3.4.1 Data analysis process

Finlay (2011) states that, at the analysis stage, phenomenology enables the researcher to highlight participants' common and contradictory experiences about the phenomenon of interest and then merge the accounts into overarching general descriptions.

As described in Section 3.4, Braun and Clarke's (2006) TA was utilised as the framework for this study to aid analysis and presentation of findings. Braun and Clarke's (2006) framework are considered the most influential approach because it provides a detailed practical guide to rigorously conduct the analysis process (Maguire and Delahunt 2017).

As mentioned, during data gathering and before the analysis, all interviews were audio-recorded and subsequently transcribed. Initially, interview transcripts were read and reread to become familiar with the data. Codes were then highlighted across transcripts, and similar codes were grouped into overarching themes. Themes were reviewed and redefined, and quotes from the original transcripts were selected to represent the themes. **Table 6** presents the six phases of analysis that were undertaken, which are further explained in the following subsection.

Table 6 Braun and Clark's (2006) phases of thematic analysis

Phase	**Description**
Become familiar with gathered data.	This phase includes data transcription; reading and rereading the data; and recording initial ideas and concepts.
Generate initial codes.	This phase includes identification of critical features in the data that are relevant to answering the research question(s); applying code tagging' to the dataset; and collating data to codes based on relevance.
Search for themes.	This phase includes examining the codes and collated data to identify broader patterns of meaning and collating codes to potential broader themes.
Review generated themes.	This phase includes examining the themes' suitability to the coded extracts (Level 1) and the entire dataset (Level 2) to generate a thematic “map” of the analysis; themes may be refined, split, combined, or discarded.

Give names and definitions for themes.	This phase includes developing a precise analysis of each theme.
Write up and produce a report.	This phase includes finalising the analysis of selected extracts; weaving the analytic narrative and data segments to relate the analysis to the research questions and empirical literature; and producing a scholarly report of the analysis.

Phase 1: **Become familiar with gathered data**

This phase requires the researcher to become immersed in and familiarised with the gathered data through reading and rereading the transcripts and listening to the audio recordings (Braun and Clarke 2013). This phase requires the researcher to make initial notes to highlight items of potential interest. Furthermore, active reading and listening to the data enables the researcher to observe the data and critically consider what the data means (Braun and Clarke 2006).

Phase 2: **Generate initial codes**

This phase is based on analysing the data by generating codes (Braun and Clarke 2006). Coding is when data that share similar features are categorised into meaningful groups. Data that were not matched with any potential theme were coded as such but not ignored to prevent any loss of contradictions within data items.

Phase 3: **Search for themes**

Phase three focuses on searching for themes by reviewing the generated codes and the coded data extracts to allocate them to potential themes. Reviewing the coded data involves observing areas of similarity and overlap between data items and collating codes that share similar features to group the data in a coherent and meaningful pattern (Braun and

Clarke 2013). Furthermore, a visual representation **(Table 7)** is used in this phase by drawing a mind map to assist the researcher in organising the coded data into their potential themes (Braun and Clarke 2006).

Table 7 Codes' allocation to potential themes

Codes	**Initial Theme**	**Subtheme**
Lacking spontaneity in daily activities Needing someone to help all the time Unable to walk Relying on family for daily tasks	Side effects of QSCI	Becoming dependent on others
Unable to pursue pre-injury hobbies Feeling powerless		Loss of participation
Depression Unable to hold PS4 DualShock controller Less social		Emotional Impact
Happiness and satisfaction Living healthy Social relationships Achieving goals	Independence and QoL	Meaning of QoL and wellbeing from the participant's perspective
Unable to take care of oneself Relying on family for daily tasks		QoL and wellbeing is affected
Play again with online friends More social	Creative OT intervention impact	How the modified PS4 DualShock controller affects QoL and wellbeing
Going back to pre-injury hobbies Trying new hobbies		Motivation after trying the modified PS4 DualShock controller
Creative Stable on thighs Reaching rear buttons		Utilisation and effectiveness of the modified PS4 DualShock controller

Phase 4: **Review generated themes**

Braun and Clarke (2013) and Maguire and Delahunt (2017) emphasise that this phase concerns checking the quality of the themes by refining them. Therefore, a focus is placed on refining the candidate themes generated in the previous phase; this includes two levels of refinement. Level one concerns reviewing the themes concerning the coded data extracts (i.e., reading the collated extracts of themes to ensure a coherent representation). Level two ensures that the structured themes are relevant to the whole dataset. At this level, the developed thematic map is assessed regarding its reflection of the authentic meaning of the entire dataset **(Table 8).**

Table 8 Initial and refined themes

Initial themes	**Refined themes**
Side effects of QSCI	Effects and outcomes of QSCI
Independence and QoL	Functional independence and QoL
Creative OT intervention impact	Influence of a modified PS4 DualShock controller

Phase 5: **Give names and definitions for themes**

This phase includes further refinement of the themes and provision of definitions (i.e., identifying the core of each theme and the significant characteristics around which each theme revolves). Thematic data is therefore reviewed and organised in a logical, internally coordinated, and coherent manner (Braun and Clarke 2013), and themes are named according to concise content to clearly inform the reader of what they are about to explore (Braun and Clarke 2013).

Phase 6: **Write up and produce a report**

This phase involves documenting the final analysis of the gathered data and is intended to inform a straightforward story concerning the data (assuring the quality and validity of the analysis). The researcher endeavours to write up the analysis concisely and logically across the various themes and subthemes and ensure that the final themes are built on sufficient data evidence (Braun and Clarke 2013).

3.5. Ethical Considerations

The direct researcher-participant relationship might be ethically challenging considering the nature of this study as might the continuous involvement of the researcher throughout the study (Sanjari et al. 2014). Dickson-Swift et al. (2007) argue that researchers face ethical challenges in all stages of a study – from designing to reporting. These include anonymity, confidentiality, informed consent, and researchers' potential impact on the participants and vice versa. Thus, the researcher confirmed that ethical considerations would be adhered to throughout the research process to ensure the participants' safety and the study's integrity (Bradshaw et al. 2017). Ethical considerations for this study were discussed according to the following stages: participant recruitment, data collection, and data analysis. The researcher complied with fundamental ethical principles of research integrity and the governance code of practice of Cardiff University (2021).

3.5.1. Participant recruitment stage

Before conducting the research, a protocol of the study was sent to Cardiff University's Research Ethics Committee (School of Health Sciences) and the rehabilitation hospital in Riyadh, Saudi Arabia through which participants were recruited. The purpose of the study was explained to the OT team supervisor who then coordinated with potential participants of 18 years or older with an interest in gaming.

The participant information sheet **(Appendix 3)** and consent form **(Appendix 7)** containing the researcher's contact details were sent to participants via email two days before conducting their interviews. This provided potential participants with ample time to familiarise themselves with the study and to ensure that any queries could be addressed before the start of the interview. In agreement with Nijhawan et al. (2013), the informed consent form was sent in Arabic and English to ensure the participants fully understood its content and could voluntarily agree to participate.

3.5.2. Data collection stage

The researcher attempted to minimise any physical or psychological harm by completing a risk assessment form **(Appendix 8)** for the hospital, as recommended by Hennink et al. (2011). The study was further described on the day of the interview to ensure that participants completely understood the study and its aim, with particular emphasis on the participants' freedom to withdraw at any time without any consequences (Doody and Noonan 2016). Participants were also informed that they could decide not to answer any questions. The informed consent form **(Appendix 7)** obtained and reaffirmed the participants' consent to be audio-recorded.

Since the interview session included face-to-face interactions, rapport and trust between the researcher and informant were expected and acknowledged (Rubin and Rubin 2012). Authors frequently mention potential ethical difficulties with the sensitivity of participants' exposure of personal information, opinions, and past experiences (Gillham 2005; Bryman 2012). As a result, for this study, participants' confidentiality was ensured by using pseudonyms and ensuring that the information supplied would only be utilized for the current research goals and would not be recognizable or shared with others (King and Horrocks 2010).

Furthermore, following instructions by Doody and Noonan (2016), the researcher's goal was to reassure participants that their remarks would be kept private by emphasising that only the researcher and their supervisor would have access to their data. The participants were also promised that pseudonyms and identification numbers or codes would be assigned to their data. The data would then be anonymously presented to third parties.

3.5.3. Storing data and the analysis stage

The researcher complied with the Data Protection Act (2018), Cardiff University’s Records Management guidelines, and the relevant legislation indicated by the hospital. Gathered data were stored securely; hardcopy data were stored in a locked cupboard and password-encrypted computer-protected digital data. All participants’ indefinable data were omitted, and pseudonyms were allocated to each transcript. Furthermore, it is the ethical role of researcher to communicate findings fairly and not to claim ownership of knowledge.

Authors frequently emphasise knowledge coproduction and conversational interaction in qualitative interviews (Holloway and Wheeler 2010; Rubin and Rubin 2012). According to researchers, interviewing is a cooperative process of discovery, and each participant's experiences and viewpoints should be recognised and acknowledged (Rubin and Rubin 2012). Hennink et al. (2011) agree, advising researchers to present a balanced view of the phenomena rather than focusing on specific topics that participants and researchers agree on.

3.6. Maintaining Trustworthiness in the Study

Qualitative research cannot be judged using the same criteria as quantitative research (Bloomberg and Volpe 2012). However, this does not mean that qualitative researchers are not concerned with the quality of their research. Qualitative research seeks the truthful reflection and representation of the participants' voices and experiences and is thus concerned with trustworthiness (Curtin and Fossey 2007; Noble and Smith 2015; Bradshaw et al. 2017). Birt et al. (2016) assert that trustworthiness is the cornerstone of conducting high-quality qualitative research.

However, unlike quantitative research, which uses the terms “validity”, “reliability”, and “generalisability” to determine the rigour of the research, qualitative research uses the terms “credibility”, “dependability”, and “transferability” to determine its trustworthiness (Bloomberg and Volpe 2012; Holloway and Wheeler 2017). The latter terminologies are discussed further in the subsequent sections.

3.6.1. Developing credibility: Triangulation, member checking, and reflexivity

Establishing the credibility of qualitative research relies on the resulting data accurately representing the participants' viewpoints (Bloomberg and Volpe 2012; King et al. 2019). This means that participants' experiences and meaning can be interpreted (Holloway and Wheeler 2017). Triangulation, member checking, and reflexivity can be used to improve the credibility of qualitative research (Bloomberg and Volpe 2012; Colorafi et al. 2016). Triangulation refers to the process through which research conclusions are generated using many perspectives, such as diverse theories, data sources, and data collection methodologies (Carter 2014; Hadi and Closs 2016).

In this study, data was triangulated by recruiting participants from various environments and professions (Holloway and Wheeler 2017, King et al. 2019). This method was used to reduce bias (Tracy 2010) and provide a more thorough view of the research topic. As a result, a wide range of facts and views were obtained (Curtin and Fossey 2007; Cope 2014). Another strategy frequently applied in qualitative research to improve credibility is member checking, which was carried out by returning the interview transcripts back to the participants (Smith and McGannon 2018). In the present study, the participants were emailed an Arabic transcript of their interviews (Cope 2014). They all provided feedback and agreed that the transcripts were accurate and that no amendments were required. This active involvement of the participants can reduce researcher bias and help validate the findings (Birt et al. 2016). It is worth noting that time elapsed between the data collection and analysis phases, and the participants' memories may have been somewhat unreliable (Bengtsson 2016).

In addition, the researcher represents the primary instrument in qualitative research and is thus heavily involved in the process (Cope 2014; Dodgson 2019). This involvement can result in subjectivity or bias (Bloomberg and Volpe 2012; Abdul-Hadi and Closs 2016). Thus, the effect of the researcher should be acknowledged while also being used through reflexivity (Bloomberg and Volpe 2012; Berger 2015). Being reflexive involves being sensitive "to the ways in which the researcher and the research process have shaped the data collected, including the role of prior assumptions and experience, which can influence even the most avowedly inductive enquiries" (Mays and Pope 2006, p. 89). For the current project, reflexivity is fundamental because the researcher has a similar cultural and professional background as the participants and has had similar experiences of the phenomenon under investigation. This presents the risk of the author "being an insider" and influencing the findings of the study due to preconceived ideas concerning the topic at hand (Dwyer and Buckle 2009; Burns et al. 2012). Reflexivity is the process by which a researcher confronts their subjectivity (Palaganas et al. 2017) by being regularly aware of how their values and background may influence the research process (Bradbury-Jones 2007; Cope 2014). Being reflexive increases the researcher's knowledge of their own beliefs, allowing them to approach the subject more openly and honestly. This enhances the trustworthiness of the research (Jootun et al. 2009). To ensure the practice of reflexivity, Ortlipp (2008) advises noting down thoughts, feelings, and assumptions made throughout the research process in a reflexive journal. This was accomplished. As another precautionary measure, the reflexive entries were often consulted, especially during analysis and documentation of this dissertation, to monitor the researcher’s thoughts, feelings, and preconceived ideas.

The researcher indicated some of the participants' cultural and professional backgrounds in the current study. Berger (2015) claims that this resemblance aids in gaining a deeper and more in-depth understanding of participants' experiences and perceptions while also enabling an understanding that the researcher should prevent bias by reflecting on their own experience. Reflexivity was applied in the present study to address thoughts and feelings that surfaced during the research process using field notes (Bloomberg and Volpe 2012). The researcher aimed to not irritate the participants by taking such notes during the interviews; instead, notes were taken afterwards (Holloway and Wheeler 2010).

3.6.2. Ensuring the dependability and transferability of the findings

Qualitative research is often unreliable, as the time, context, and place cannot be entirely replicated (Finlay 2006). However, it should be noted that qualitative research can be validated, and the circumstances in which data are gathered may be repeated in similar or related circumstances (Shenton 2004; Holloway and Wheeler 2017).

Furthermore, qualitative research is concerned with the concept of dependability rather than reliability (Bloomberg and Volpe 2012), whereby a clear and in-depth description of the study process is provided so that the reader (Holloway and Wheeler 2017) can quickly follow it. Providing such a detailed description allows readers to evaluate the trustworthiness of the research (Curtin and Fossey 2007). A detailed description of the study background and methodology was provided regarding the current study to enhance dependability.

However, the researcher in qualitative research does not aim to generalise the generated findings to a broader population (Finlay 2006). Instead, they are concerned with the concept of transferability (King et al. 2019) and aim to ensure that the reader may judge their findings as transferable to broader populations who share similar characteristics and demographics (Mays and Pope 2006; Curtin and Fossey 2007). Similar to dependability, transferability was enhanced in this study by providing a detailed description of the particularities relating to the research process (Colorafi 2016; Green and Thorogood 2018).

3.7 Rigour of the Study

Rigour is defined as “the authoritative evaluation of good research and the unspoken standard by which all research is measured” (Davis and Dodd 2002). In general, the methods used to ensure rigour in a qualitative study involve different components of quality. Creswell (2014) suggests that researchers use at least two methods to enhance rigour. Rigour in this study was addressed through use of a purposeful sampling strategy, site triangulation, follow-up interviews, debriefing sessions, reflexivity, and member checking. Purposeful sampling was used to identify patients with a QSCI. Mays and Pope (2006) suggest using this sampling strategy to ensure the rigour of the study, as it allows the researcher to identify participants who can provide data to answer the research questions. Additionally, it enables exploration of the phenomenon as participants experience it. This also minimises bias arising through selecting participants based on convenience (Mays and Pope 2006). In addition, site triangulation (i.e., recruiting participants from several support groups within different areas) was used to reduce the effects of studying participants in one area and to explore the diversity of different people's experiences (Shenton 2004).

One follow-up interview was conducted with each participant to explore the essence of their experience in more detail and to address any gaps in the emerging analysis (Morse et al. 1994). Moreover, frequent debriefing sessions were conducted between the researcher and the research supervisor. Such discussion sessions were useful in allowing the researcher to identify flaws in the research process as well as her own biases. They also aided the researcher in developing her ideas and interpretations (Shenton 2004).

In addition to the procedures outlined above, the researcher used reflexivity to analyse the study as it progressed. "Reflexivity refers to the assessment of the influence of the investigator's personal history, views, and interests on the qualitative research process," writes Krefting (1991). For the purposes of this study, reflexivity took the form of intersubjective reflection, in which the researcher concentrated on the nature of the research encounter and how the unconscious process established a mutual bond between the researcher and participants (Finlay 2006). More than reflection, the process required intersubjectivity. Intersubjectivity is defined as what exists and is shared by subjects. Thus, it considers the face-to-face, discursive, and social characteristics that enable the researcher to access, communicate, understand, and experience the world of participants through the participants' experiential senses (Husserl 1983).

Moustakas (1994) notes that the rigour of a study is improved through checking the data with participants. This is because participants can review and alter or confirm the research data to match their perception of the experience. Participants may also feel that their contributions are valued as new knowledge on the topic (Moustakas 1994). As a result, each participant was subjected to a member check. They were sent an email with their own textural-structural description for review, and they were asked to look over it and make any necessary additions and modifications. As previously indicated, all seven participants agreed that these descriptions were true.

3.8. Ethical Approval

This study was conducted following an application to the Ethical Committee at Cardiff University. Favourable ethical opinion was given, and approval was granted on June 28, 2021 **(Appendix 9).**

3.9 Funding

This study did not obtain any funding. The researcher performed the translation of the interview transcripts. There was no honorarium offered to participants for agreeing to participate.

3.10 Summary

This chapter has explained the data collection procedure and included information about how participants were recruited, their demographic information, and the semi-structured interview process. It has also explained the data analysis procedure and outlined ethical considerations. The study's findings are described and discussed in Chapter four.

4. CHAPTER FOUR

4.1. Findings and Discussion

Seven semi-structured interviews were conducted between 21 August and 10 November 2021 in Riyadh, Saudi Arabia. Before scheduling the interviews, each participant was provided with a copy of the invitation letter, participant information sheet, and informed consent form (Appendix 2,3,7). A comprehensive analysis, comparison, and examination of the data collected from the interviews will be discussed in this chapter.

In accordance with Rubin and Rubin's (2012) statement concerning the co-production of knowledge through qualitative interviewing, this chapter aims to represent interviewees' narratives concerning applying the modified DualShock controller and provide critical discussion concerning the findings. Braun and Clarke's (2006) TA format were utilized to generate codes and group the codes into three main overarching themes.

Three themes and eight subthemes emerged from the day-to-day life stories of participants **(Figure 3)**. The three themes are as follows: (a) effects and outcomes of a QSCI, (b) functional independence and QoL, and (c) influence of a modified PS4 DualShock controller. Data were obtained concerning QoL, dependence on others, loss of autonomy, inability to engage in leisure activities, and the participants' experiences using the modified PS4 DualShock controller.

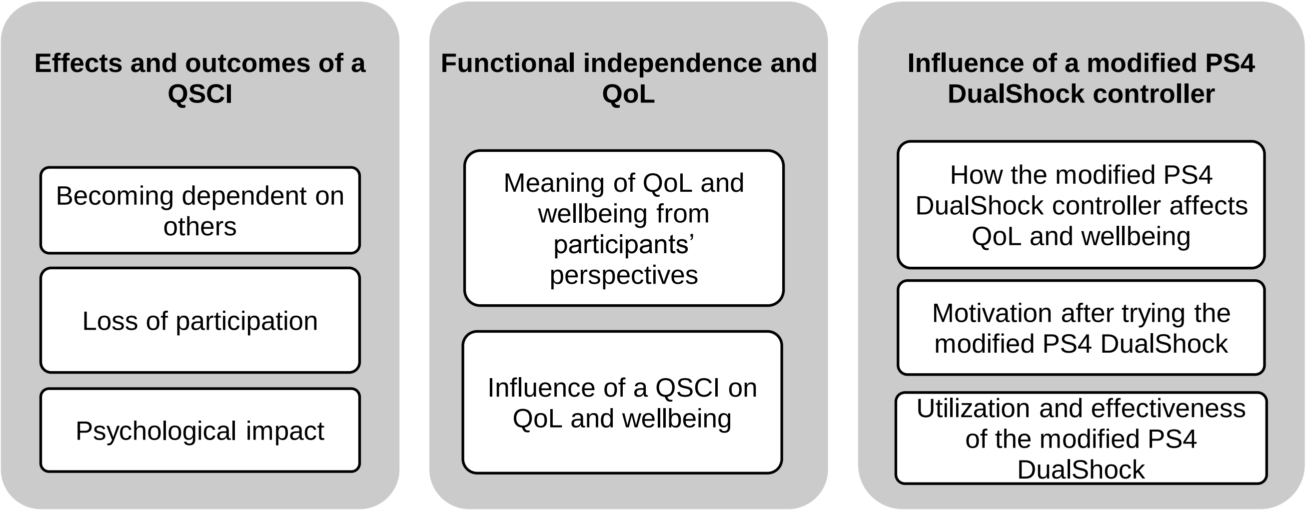

Figure 3: Themes and subthemes

The themes were critical in addressing the research question by examining the study's phenomenon and implications in practice. This information examines QSCI from the incident level, its impact on independence and QoL, and how this data can be used to implement a modified PS4 DualShock controller intervention.

4.2. Theme One: Effects and Outcomes of Quadriplegic Spinal Cord Injury

In this study, QSCI complications reported by participants were divided into three subthemes: becoming dependent on others, loss of participation, and psychological impact. Examining these effects is critical to understanding the implications of QSCI on QoL and wellbeing. The subthemes are critical in supporting the broader theme of complications and secondary difficulties following a QSCI. Participants had experienced a loss of freedom and became dependent on others. They experienced difficulties pursuing their hobbies after the injury, which negatively impacted them and often provoked depression.

4.2.1. Being dependent on others

Quadriplegic spinal cord injury participants spoke about being bound to their injury. According to the affected people, losing independence and freedom was one of the most bothersome elements of having a QSCI. Loss of independence and freedom meant relying on others for basic mortar and mobility needs and having limited movement room. According to the study, dependence on others for basic needs and living according to someone else's schedule is linked to emotions of "loss of control over one's life and body." Abdulaziz, a QSCI participant, discussed his loss of spontaneity and freedom as a result of his constant need for assistance in even the most basic daily activities:

> I cannot walk anymore, and now I need someone with me all the time. I am dependent on someone else; I now rely on my brothers to groom and drive me to the party/occasion. I could not be spontaneous with my movement anymore. [Abdulaziz]

As for Faten, she stated that being unable to take care of herself after the injury affected her wellbeing and independence:

> Ever since my injury, I could not take care of myself. Therefore, I relied on my family for eating, dressing, showering, almost everything. Therefore, this affected my sense of independence and wellbeing. [Faten]

The QSCI patients' well-being and sense of independence were affected by their dependence on others for their daily routine. This is consistent with previous research findings. For example, Andrén and Grimby (2004) state that increased dependence on daily activities may reflect reduced capacity, changes in interests, preferences, and social circumstances. Participants also reported challenges while performing daily self-care routines. These secondary difficulties have a detrimental influence on patients' perceptions of QoL, which is the ultimate aim of rehabilitation (Hammell 2010).

4.2.2. Loss of participation

Two participants reported that they could not participate in their hobbies to the same extent as before their injuries. Abdulaziz reported the following:

> I used to go out and socialize all the time. One of my passions is horseback riding; I enjoy it so much that I now just see them (horses) since they remember me. [Abdulaziz]

Mohammed's inability to participate as he once did may have affected a future career option; he described this as follows:

> What got me is that I could not play the guitar as I used to, which is a hobby that I have cherished since I was a teenager, and I am good at it. It affected my personal goal of being an artist and a musician, as I have written many songs. [Mohammed]

Every participant highlighted activities and participation as a critical component of QOL. Additionally, Khalifah, who used to be a teacher, reported that he lost his job because of his injury. He said, "It is hard and challenging to hire people with disabilities, particularly in teaching."

Data from the interviews show that most participants lost their functional skills to engage in leisure activities. Wang et al. (2018) observe that affected persons cannot move around or handle objects. Therefore, people like Mohammed and Khalifa yearn to regain mobility or dexterity to eliminate the feeling of helplessness (Wang et al. 2018). These limitations result from a compromised body on the capacity to engage in preferred activities for people following a QSCI (Hammell 2006). Affected persons are left with few choices regarding the frequency and type of participation activities they can engage in.

4.2.3. Psychological impact after a quadriplegic spinal cord injury

Apart from the participants' discussion on the loss of independence and inability to pursue their hobbies, they also spoke about their experiences using the standard PS4 DualShock controller after their injury. They reported the realization that they could no longer hold the device. Furthermore, they could not reach or press the back buttons, and they reported that this made them feel depressed and antisocial. One of the participants notes that he enjoyed playing FIFA, a PS4 football game. Upon recognizing that he could not play the game anymore, he became depressed:

> I used to love and enjoy playing FIFA on my PS4, but once I tried holding the DualShock controller and not being able to, it was a little bit depressing. [Abdulaziz]

Faten, one of the QSCI participants, described how the injury incapacitated and frustrated their efforts to handle the DualShock controller:

> After my injury, I tried playing once, and when I found out that I could not reach the back buttons of the DualShock, I threw it and never touched it again; somehow, this made me depressed and less social. [Faten]

Three of seven participants reported that the inability to engage in leisure activities made them feel depressed and less social in the third subtheme. The majority of the study participants had not accepted their condition, which predisposed them to a greater risk of developing depression, as Burcusa and Iacono (2007) state. These experiences align with Borell et al.'s (2001) observation that such instances of depression correspond to the unpleasant emotion of becoming a burden to others and the negative feeling of being chained to one's house.

One of the main factors that lead to depressive symptoms is a lifestyle change. As Ripat and Woodgate (2012) notes, the main concerns of disabled persons are the same as those without a disability: to live a meaningful life and participate in social and occupational activities of ones' choosing (Ripat and Woodgate, 2012). If a person lacks in these functional areas, they become stressed. All participants spoke about being limited in their physical movements, managing routine, and everyday tasks in this study. They reported that their physical limitations prevented them from completing certain tasks and engaging in activities independently, affecting their QoL.

4.3. Theme Two: Meaning of Quality of Life and How It Is Affected

Participants primarily defined the main component of QoL as being physically active or engaging in meaningful activities. Studies have demonstrated that QoL is affected by one's ability to engage in meaningful and purposeful occupations (Brekke et al. 2019). Similarly, the concept of QoL is often considered to be determined and impacted by one's environment (Graham, Rodger, and Ziviani, 2012). However, no instruments have been devised to assess QoL for QSCI patients. The current study evaluated participant responses regarding the impact of QSCI on QoL. The collected data was divided into two subthemes: the definition of QoL concerning spinal cord injury and the effect on QoL.

4.3.1. Meaning of quality of life and wellbeing from participants' perspectives

For this study, the definition for QoL as the experience of living a life worth living was adopted (Hammell 2007). Generally, participants in this study described QoL as a standard of health, comfort, and happiness. While QoL is relative and subjective with intangible components (for example, spiritual beliefs and a sense of belonging), the WHO has defined it as an individual's perception of their position in life in the context of the culture and value systems in which they live and concerning their goals, expectations, standards, and concerns (Skevington, Lotfy, and O'Connell, 2004).

Salem described QoL as a sense of independence, stating, "It is doing what you want to do and enjoying it." Faisal expressed that QoL is more concerned with overall health and wellbeing: "QoL is something that promotes health and wellbeing." Furthermore, Mohammed defined QoL as follows**:** "I think it means happiness, achieving personal goals, being healthy, maybe just living a normal life." Hammell (2010) uses the phrase to refer to people's happiness regarding their lives and their general feeling of wellbeing. Data from the interviews show that QoL is a critical area in QSCI intervention and can be used as an indicator in monitoring health status and treating disorders like anxiety.

As mentioned above, one participant identified QoL as living happily while achieving personal goals. Faten described QoL as the ability to engage in leisure activities whenever an individual desires to. This statement is consistent with previous findings from existing literature on the topic. In these studies, QoL is defined as being influenced and improved by determinants such as having meaningful connections, using one's abilities and principles, and having control over one's daily life because these elements help an individual in developing self-worth and self-sufficiency (Hammell 2007; Bergmark et al. 2008; Duggan et al. 2016; Clifton et al. 2018; Geard et al. 2018; Simpson et al. 2020).

4.3.2. Influence of a quadriplegic spinal cord injury on quality of life

When participants recalled experiences from their lives before the injury, they described being involved in numerous roles that were meaningful to them. For example, Abdulhafeth shared that he liked to be physically active, whereas Faten mentioned frequently playing PS with her friends.

> My quality of life has majorly been affected after the injury. I mean, I used to enjoy playing football in college with my friends. I used to go to book clubs; we used to do FIFA tournaments every weekend and go sand skiing in the winter. [Abdulhafeth]

> I think my quality of life has been affected in so many ways after my injury. For example, I used to enjoy playing PlayStation 4, especially FIFA games. I used to play all day long, sometimes online, with my friends. [Faten]

Regarding hobbies, participants described how their QoL had been affected after their injury. Additionally, the ability to spend time occupied with something personally meaningful has been linked to QoL. This supports the OT premise that occupation is a source of meaning, purpose, choice, and control and that engaging in personally meaningful occupations contributes to the experience of a life worth living (Townsend et al. 2003).

4.4. Theme Three: Influence of a Modified PlayStation 4 DualShock Controller

The section discusses the influence of the modified DualShock controller on participants after they participated in a meaningful leisure activity (gamed for 45 minutes). The responses provided by the participants show that they have a strong desire to regain autonomy in functionality. This researcher hopes that participants may be influenced to attempt other new activities post-injury or to continue aiming to recapture what they used to enjoy pre-injury (with the assistance of their OTs and rehabilitation team). Findings modelled for this theme can be used to explain the role of a modified DualShock controller on improving feelings of independence and autonomy for individuals with a QSCI. Moreover, the creative technology used in the device and its impact were reported by participants and described in the following subtheme sections.

4.4.1. Motivation after trying the modified PlayStation 4 DualShock Controller

Concerning this first subtheme, participants reported that a capability to do what they did pre-injury, like play PS4, might motivate them to try new things such as horse riding or drawing. However, due to the nature of the study, it cannot be confirmed whether they will achieve this. OTs can use these results to model interventions that promote engagement in diversified leisure activities. In this regard, identifying the meaning of activities to patients is one method for analysing and understanding what might motivate them (Teitelman, Raber, and Watts 2010). Understanding a patient's motivation to participate in activities they must do and enjoy doing is critical in designing the treatment plan that they will follow in their rehabilitation process (Carin-Levy et al. 2009).

Three out of seven participants reported feeling motivated after trying the modified DualShock controller. They were more likely to try new activities and resume their previous hobbies with the help of their OTs. This can be recognized through Abdulaziz's description of his experience:

> It motivated me to try and ride my horse again since I never thought of doing so because of my injury. But also, it is the same with playing PS4, as I never thought I could play again and play very well with this modification. I am not sure if I need any modification to ride my horse, but I'll try with my occupational therapist. [Abdulaziz]

For Khalifah, it has been 14 years since his injury, and he spoke about how the modification provided him with the motivation to attempt other activities after discovering that he could return to playing PS4:

> It motivated me to try other games like cards and hobbies such as drawing. Why do I prevent myself from trying new things since I could play PS4 now? [Khalifah]

Faten described how she was motivated to try new things with the help of the rehabilitation team:

> After trying it, somehow, it gave me the motivation to try new things and other things I thought I would never be able to do, such as riding a horse. I am not sure how I will do that, but I'm pretty sure I'll be able to do it with the help of the rehabilitation team. [Faten]

The other four participants, Salem, Abdulhafeeth, Faisal, and Mohammed, also reported being motivated to try and play PS4 again as they used to before their injury.

4.4.2. How the modified PlayStation 4 DualShock controller affects the quality of life and wellbeing?

Participants reported and explained that playing PS4 again positively affected their mood and allowed them to enjoy socializing and participating with others in a leisure activity:

> It [playing PS4] changes the mood. As long as I am sitting at home all the time, now I can play with my siblings and friends. I can finally do something I enjoy and love as a leisure activity and somehow enhance my wellbeing. [Abdulaziz]

> I will be able to play again with my online friends; I will be inviting my friends to my house to play together. This modification will improve my QoL and wellbeing by making me the social person I used to be. [Faten]

Many participants reported that successfully trying the modified DualShock controller device positively affected their mood in the second subtheme. In turn, they expressed that this positively impacted their QoL and wellbeing. There is evidence that favourable QoL, or wellbeing, is linked to positive relationships and participation in social, voluntary, leisure, employment, and community activities (Hammell 2007). Additionally, such participation may reduce secondary medical problems, which adds value to this type of approach (Elliott, Bush, and Chen, 2006).

Furthermore, since research suggests that dissatisfaction with life after a QSCI may be due to social disadvantages rather than the injury (Hammell 2004b), a focus on meaningful living may allow researchers and clinicians to investigate and address facilitators and barriers to participation at both individual and community levels. Vahdat et al. (2014) also addressed the factors affecting life frustration after their QSCI, noting that patients' primary concern is the influence of the compromised body on their ability to engage in preferred activities (Vahdat et al., 2014). Moreover, a link has been revealed between the reduced ability to execute valued daily actions and a loss of self-worth (Hammell, 2006).

4.4.3. Utilization and effectiveness of the modified PlayStation4 DualShock Controller

The section discusses the benefits and effectiveness of using the modified DualShock controller with reference to the participants' perspectives. For example, Faten was pleased with the usability of the device.

> It [the modified DualShock] is effective and honestly creative in reaching the buttons from the back and how it is stable while I play. I do not have to be concerned about holding the DualShock controller while playing. [Faten]

Abdulhafeeth advised that the modified DualShock controller would also be usable for people with upper extremity weaknesses:

> I mean, who does not have hand movement or the needed dexterity for DualShock controller holding and pressing back buttons? This will help, and it is very creative. [Abdulhafeeth]

Abdulaziz expressed his excitement about how functional the modified DualShock controller was while playing FIFA, a football game on PS4, helping his player run faster. He shared the following:

> With the modification, I do not have to hold the DualShock controller since it's stabilized on my thigh. Now, I can easily reach the back button R2\L2 for running, which is critical in playing FIFA. [Abdulaziz]

Concerning the third subtheme, participants discussed the modification and the effectiveness of the modified DualShock controller device. The participants were happy with the functionality of this modification because they no longer required the dexterity to press the rear buttons. Rather, the handles on the sides can be pressed. There was an emphasis on the ease of using the device without worrying about holding it. Thus, innovativeness is crucial in demonstrating creativity in OT therapies. The technology used can be applied in diverse clinical settings and modified to suit various needs, including those of the disabled population (Schmid, 2004; Ernst and Moore, 2013).

4.5. Summary

The analysis of the generated data yielded three key themes, each with its subthemes detailed in this chapter. The first theme was used to explore the effects of a QSCI on participants' hobbies. The participants reported that they could not handle the standard DualShock controller after a spinal cord injury, which had negative mental effects. Data from the second theme suggested that the participants' QoL and independence had been significantly impacted due to their QSCI. The individuals in this study were all at different points in their post-injury lives due to the different lengths of time (one to 14 years) following injury. According to Solomonow, Baratta, and D'Ambrosia (2000), it may take at least nine years for people to adapt to living with a QSCI in terms of personal responses and external conditions. This research has only minimally captured the qualities of such growth for each person. For example, participants who had been injured the longest tended to express greater happiness about their lives when compared with those who had been disabled for less than six years. This supports previous observations (Solomonow, Baratta, and D'Ambrosia, 2000).

In this study, autonomy – or the ability to lead and control one's own life – was demonstrated as being significant; study participants related it to the ability to direct their care, make decisions, and act on them. Shavelle et al. (2006) note that autonomy is a critical aspect of life for QSCI patients enabling them to maintain personal dignity and QoL. Control is more than a matter of choice in affected populations, meaning injured persons may make decisions. However, they have limited influence over how they act on them. In these cases, control is contingent on the opportunities available in one's environment and varies according to their state of wellbeing (Townsend et al. 2003).

Nevertheless, QoL, alongside senses of value, competence, skill, and self-worth, is required to fill time with something personally meaningful. This supports the concept of OT: that occupation provides meaning, purpose, choice, and control and that engaging in personally meaningful occupations adds to the experience of living a life worth living (Townsend et al. 2003). OT theory can be conceptualized as purposeful and meaningful. The terms can be used interchangeably to describe purposeful, goal-oriented, and socially sanctioned energy and time use (Hammell 2014).

OT interventions are modelled through an assessment of QoL and its influence on the performance of activities. Findings from this study on participation and active living support Chun and Lee's (2008) understanding that, when a person suffers a QSCI, "it is not simply that the individual can't walk anymore; it is that the activities of life that were formerly enjoyable and self-defining are no longer available."

Through examination of data gathered in the final theme, participants expressed their thoughts concerning the impact of the modified PS4 DualShock controller being beneficial. The subjects noted that they considered the act of playing positive, and this may motivate them to potentially attempt new games or activities they used to enjoy. However, the device was limited in benefits and could only be used in cases where innovative technology was applied. Additionally, some participants noted that the DualShock controller modification was beneficial regarding how stable it felt and how easy it was to access the rear buttons.

This chapter discusses the study's findings, including the problems that participants experience in their daily lives because of their QSCI and how the condition affects their QoL and social life. The adoption of DualShock controller modification in the affected population significantly improved their emotional, and social wellbeing. Implementing an adaptive technological device was perceived by the participants as an important enabler of autonomy that enables them to engage in leisure activities. This has been presented concerning previous literature on the subject. Chapter five summarizes the overall conclusions of this study.

5. CHAPTER FIVE

5.1. Conclusion

This last chapter summarises the key findings and conclusive statements of this dissertation. Acknowledging that every study has its limitations (Bloomberg and Volpe 2012), a consideration of this study's limitations is also discussed. Lastly, suggestions for further research regarding the implications derived from this study are incorporated at the end of this section.

5.1.1. Summary of key findings and implications

In this qualitative study, the following factors have been identified as essential to one's QoL: (a) being able to regulate one's own life and care, (b) being able to engage in meaningful and goal-directed activities, and (c) being able to experience social interactions (Hammell, 2004a). In addition, study participants shared a sense of their realigning their priorities and transforming their understanding of life with a QSCI into a sense of ability, worth, accomplishment, and motivation (Dorsett et al. 2017).

Moreover, for rehabilitation to be meaningful and relevant, it must help individuals in regaining control of their lives. It must also facilitate the exploration of options and opportunities (Bradley, Baker and Bailey, 2019). In addition, it must encourage participation from people with disabilities and assist them in locating the purpose and meaning in their lives (Krahn, Walker and Correa-De-Araujo, 2015). As O'Brien (1992) stated, people weave better lives from the resources that available opportunities and services help provide them with.

Concerning QoL, it is defined as how people perceive their role in life in terms of the cultural and value-based frameworks that are present where they live (Estoque et al., 2018). It also includes a person's goals, desires, principles, and concerns (Thorgrimsen et al., 2003). Quality of life is a broad term that organises actual prosperity, mental health, adaptability, social relationships, and personal feelings (Chang et al. 2012). This study has described the experiences of seven patients with video-gaming experience and a QSCI who tested the modified PS4 DualShock controller device.

However, QoL can also be seen as an interface between one's sense of wellbeing and one's ability to pursue life goals. Moreover, in health care and modern technology, people with disabilities are considered a viable market (Chen 2012; O'Reilly 2012). Industries frequently tout product enabling features that they claim can increase the QoL for older adults, people with disabilities, and their caregivers. Remarkably, QSCI is a significant medical disorder that frequently results in severe morbidity and long-term impairment (Eckert and Martin, 2017).

Furthermore, OT creative treatment is described as the art and science of assisting people with daily chores (Müllersdorf and Ivarsson, 2012). It is vital in improving patients' health and welfare through meaningful occupational involvement (Crepeau et al. 2009). Gallagher et al. (2015) discovered that, when people make purposeful and meaningful decisions in their daily activities, their health and wellbeing improve.

Generally, information about QSCI patients' real-life experiences with AT/modifications related to gaming is scanty (Folan et al. 2015). Therefore, there was a need to investigate the impact of creative AT from an OT standpoint. This current study has examined how QSCI patients experience everyday life and how their injury affected their QoL and wellbeing. How people manage and adapt to the issues and obstacles they face due to their disability and how this affects their QoL, motivation, and leisure activities were examined.

For this study, Braun and Clark's (2006) stages of TA were used to aid in analysis. Participants provided interview data about their everyday experiences and coping strategies regarding different occupational areas of self-care and leisure. Problems included a lack of independence, as they must rely on others in getting dressed and moving from place to place, for example. Participants further described how, after using the DualShock controller modification, they felt motivated to participate in other activities with help from their rehabilitation team. Thus, a key finding of this study is that the DualShock controller modification enabled participants to recognise that, with the right adaptations, they can engage in some of their meaningful pre-injury occupations and attempt new and meaningful occupations and hobbies. This study has thus illustrated those creative interventions and environmental adaptations may be able to encourage people with a QSCI to engage in occupations that are meaningful to them and that such implementations may enhance patients' QoL.

Analysis of the data related to the first theme indicated the complexities and subsequent challenges that participants faced after a QSCI. Data revealed that they had trouble pursuing their hobbies following the injury, which negatively impacted them and primarily contributed to depression.

Analysis of the data related to the second theme demonstrated that independence is strongly associated with QoL and happiness. According to studies, one of the most critical aspects of QoL is engaging in meaningful and purposeful activities (Brekke et al. 2019).

Finally, the data related to the third theme presented the impact and influence of the modified DualShock controller after 45 minutes of play. As participating in meaningful activity was a strong motivator in this study, the data here provided insight concerning whether individuals might decide to try new activities or return to activities they used to enjoy with help from their occupational therapist and rehabilitation team.

Furthermore, although the current study provides valuable information, several elements remain unexplored. Moreover, there is limited research concerning rural communities and how AT may be able to help rural individuals with a QSCI or whether AT is available to people living in these areas. There is also limited research concerning AT in many nations around the world. Most studies (Hooper et al. 2018; Monden et al. 2019; Muller et al. 2017; Rigby et al. 2011) are from the United Kingdom, the United States, Canada, and Australia.

Meta-synthesis of a qualitative study about people with QSCI's perceptions of QoL is recommended for researchers to determine how this is measured and what elements add to – or detract from – a sense of a life worth living (Hammell 2004b). More qualitative research is needed to accomplish this and to develop assessment techniques that allow people with a QSCI to define their QoL domains. These techniques can also help toward developing treatments in these domains (Mays, 2000).

To summarise, as occupational therapists have the experience and knowledge to enable persons to accomplish activities to maintain QoL, practitioners must consider – and design improved treatment plans – to help QSCI patients better adapt to their condition. In addition to analysing the problems experienced by people with a QSCI (i.e., what they can do and how they cope), their various needs should be considered, and practitioners should strive to effectively aid their reintegration into society. People with a QSCI do not seek sympathy and providing them with creative solutions so that they can participate in their leisure activities may positively impact their QoL and wellbeing.

5.1.2. Implications for practice

The findings of this study clearly demonstrate the relevance of creativity in the practice of OT. It will be interesting to see how creativity may be emphasized more in occupational therapy practice, with evidence-based practice serving as the driving force to produce measurable and data-driven outcomes. Finding the extent to which creativity contributes to these quantifiable results could be a next step in evaluating its usefulness to the profession, with occupational therapists indicating that creativity is a critical component of therapy planning and procedures (Rodrguez et al., 2019). As stated by Juth, Smyth and Santuzzi (2008), patients may have various problems, but many of their struggles are the same. The social and emotional aspects of living with a QSCI are powerful and dominant and, as illustrated in this study, may shatter patients' confidence, and negatively influence their social lives. As an OT, managing such issues requires a close relationship with patients and sufficient sensitivity to their emotional and social needs (Phadsri et al. 2021). An evaluation of a patient's physical abilities and an awareness of their interest in gaming may allow modification or adaptation to an assistive device that could broadly assist in increasing patients' social participation. This evaluation could be achieved by involving participants in readily accessible gaming tournaments with aim to reduce their burden of living with a QSCI and improve their QoL.

Finally, the findings of this research can be utilised to design and manufacture assistive devices that are more tailored to the needs of people with a QSCI.

5.1.3. Limitations

Limitations are potential flaws that arise in a study and are beyond the researcher's control (Simon 2011). Qualitative research has advantages and disadvantages in terms of internal validity. All opportunities (i.e., treatments, interventions, experiences, and experimental procedures) during a study that impede the investigator's ability to make the correct conclusions from the data collected are considered threats to internal validity (Creswell 2014). Because qualitative research is frequently conducted in natural settings, replication is challenging (Wiersma 2000). Limitations are transferability constraints that make reproducing a study conducted in a natural setting difficult (Simon 2011).

To reduce the risk of bias, the researcher used an epoché and bracketed her individual experiences and expertise by maintaining a journal and conducting honest self-reflection on feelings that influence the data gathering procedure (Hein and Austin, 2001; Tufford and Newman 2010).

While this study has aimed to provide an in-depth picture of seven participants' experiences, the sample size was small. All participants were recruited from one SCI rehabilitation unit from one hospital in Riyadh, Saudi Arabia. Therefore, the obtained findings are not necessarily conclusive and may not be generalisable for other contexts. Other shortcomings included the scarcity of previous research that has considered QoL motivation as a main factor in OT treatment and that most of the identified literature stemmed from the 1980s and 1990s.

Limitations derived from the sample should also be noted. The sample in this study was more male-dominant than samples in other studies. Therefore, the findings of this study predominantly apply to the male population.

Further research based on a larger sample size and more studies examining how AT (especially in gaming) could affect the QoL and wellbeing of QSCI patients are thus recommended.

5.1.4. Recommendations for future research

Future research must move beyond gathering demographic predictors of secondary illnesses to generating solutions that satisfy the needs of individuals with a QSCI and enhance their QoL. People living with a QSCI express, perhaps unsurprisingly, that they have invested time and energy in research that either appears to be of little relevance or has ended up “in a desk drawer”. Additionally, commitment from researchers to ensure that such findings are translated into practical actions may appear limited (Abma 2005). On the same note, people with a QSCI may have different perspectives on their needs than researchers. Quadriplegic spinal cord injury researchers have not typically gathered patient feedback in constructing suitable or relevant therapies (Elliott and Kennedy 2004). When defining research agendas, it has been stated that considering the goals of individuals with a QSCI would guarantee that research is relevant, resulting in better care and QoL for such patients (Abma 2005).

For occupational therapists, AT can help participants with a QSCI engage in meaningful occupations and valued roles (Folan et al. 2015; Muller et al., 2017; Baldassin et al. 2018; Hooper et al, 2018; Verdonck et al. 2018), which is considered to improve overall life satisfaction (Folan et al. 2015).

In conclusion, the QSCI patients in this study had an interest in gaming. Therefore, future research might illuminate their experiences with different AT and how such approaches affect their QoL. By combining the work of an OT with that of an assistive technologist, future ventures might help minimise the burden of living with a QSCI. It is also essential to consider the patient's intrinsic and extrinsic motivations when conducting future research and assess how their daily activities, occupations, and adherence to a treatment plan may be affected by numerous factors influencing patient motivation, such as patients' goals, experiences of success and failure, physical condition and cognitive function, resilience as well as the influence of rehabilitation professionals, social relationships among patients, and patients' supporters. Moreover, the literature can be broadened by conducting studies in non-English languages to support QSCI patients in non-English speaking nations.

Given the information shown thus far, it is reasonable to assume that the modified PS4 DualShock Controller has an influence on the QoL and well-being of people with QSCI. It is a suitable modification for achieving better health outcomes. Finally, implications for practice, the limitations of this study, and recommendations for future research were discussed in this chapter.

Reflexivity statement

My first three years after graduating BSc were spent working as an OT primarily with QSCI patients, where I grew an interest in adaptive devices. As a result, it was easy for me to choose my topic for my master's dissertation.

Because of my interest in this topic, my master’s dissertation was inspired by my work at the SCI rehabilitation unit. There, I saw first-hand how significantly a simple activity can affect a patient's QoL and wellbeing, even making them want to try new things.

QSCI is a lifelong disability, so a lot of my QSCI patients suffer from depression, therefore the first ever modified controller was created to enable them to participate in gaming with their able-bodied peers. As a result of my own experience with PS4 and professional knowledge of QSCI patients, I designed a modified DualShock controller to aid QSCI patients with gaming and to improve their quality of life.

The feedback I received from my patients back then was valuable, especially since it had a significant impact on their mental and psychological health. Hence, I pursued it as a master’s topic and patented the modified controller as part of my effort to validate it. However, there were some challenges encountered during the research process, notably during the data collection phase. For example, scheduling patients was difficult because of their busy treatment schedules during the day. In addition, the collection of data took longer than anticipated since few QSCI patients were admitted.

My goal is to make the patent modified controller available to as many QSCI patients as possible in the future. Additionally, I hope that the data collected, and results obtained will help Occupational therapists and researchers understand how adaptive equipment affects patients' quality of life.

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Appendices

APPENDIX 1 INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

عبد العزيز للخدمات الإنسانية
SULTAN BIN ABDULAZIZ HU HUMANITARIAN CITY

Date: 08/08/2021
IRB No.: 50-2021-IRB

To:Ms. Sarah Mohammad Alageel
PI: "A qualitative study exploring the impact of a modified PS4 DualShock controller created by occupational therapist on the wellbeing of quadriplegic spinal cord Injury patients in Riyadh, Saudi Arabia." Sultan Bin Abdulaziz Humanitarian City
E-mail: Sara.AlAqeel.OT@gmail.com

Subject: Approval for Research No. 46/MSc/2021
Study Title: "A qualitative study exploring the impact of a modified PS4 DualShock controller created by an occupational therapist on the wellbeing of quadriplegic spinal cord Injury patients in Riyadh, Saudi Arabia."
Study Code: 46/MSc/2021
Date of Approval: 05/08/2021
Date of Expiry: 06/02/2022
Board approval: All members
Dear Ms. Sarah Mohammad Alageel,

Your Project has been approved and you have the permission to conduct this study following your submitted documents as follow:

1. Curriculum Vitae for the PI researcher
2. Letter from the researcher requesting SBAHC participation in the clinical study
3. Research proposal according to SBAHC IRB Guidelines
4. Research Obligatory Agreement. Available upon the completion of the other requirements
5. GCP and NCBE Certificate

You are required to obey by the rules and regulations of the Government of Saudi Arabia, the SBAHC IRB Policies and procedures and the ICH-GCP guidelines. You have to note that this approval mandate responding to IRB's periodic request and surveillance result. Drawing your attention to the following:

- Amendment of the project with the required modification to providing Periodical report for this project specially when study extension is required or expiry before

study completion
- All unforeseen events that might affect continued ethical acceptability of the project should be reported to the IRB as soon as possible
- Any serious unexpected adverse events should be reported within 48 hours (2 days)
- Personal identifying data should only be collected when necessary for research.
- Secondary disclosure of personal identifiable data is not allowed.
- Monitoring: projects may be subject to an audit by the IRB at any time.
- The PI is responsible for the storage and retention of original data pertaining to the project for a minimum period of five (5) years.
- Data should be stored securely so that a few authorized users are permitted access to the database.

The IRB registered with the IRB KACST Registration No. H-01-R-090. It is authorized to conduct the ethical review of clinic studies and operates in accordance with ICH-GCP Guidelines and all applicable national/local and institutional regulations and guidelines which govern Good Clinical Practices.

For Future Correspondence, please quote the project number and project title above and you are requested to keep IRB informed about your study progress and submit project progress report every six (6) months. A final report should be provided upon completion of the study.

Wish you a success in your research project.

Yours sincerely,

Dr. Khalid Al-Rubeaan
Chairman-IRB
Sultan Bin Abdulaziz Humanitarian City

APPENDIX 2 INVITATION LETTER

Appendix 2: Invitation letter

Sara Alageel
School of
Healthcare Sciences
Cardiff
University
Mobile: 00966590616111

Invitation to participate in a study

Title of the study: A qualitative study exploring the impact of a modified PS4 DualShock controller created by an occupational therapist on the wellbeing of quadriplegic spinal cord Injury patients in Riyadh, Saudi Arabia

I am inviting you to take part in a research study regarding your experience of using a modified DualShock while playing PS4. The aim of the study is to explore the potential impact of a modified PS4 DualShock on the QoL of adult patients with QSCI in Sultan bin Abdulaziz Humanitarian City (SBAHC), Riyadh, KSA. I am inviting all QSCI who are 18 years old and above, both men and women to share experiences about using the modified DualShock while playing PS4. PS4 DualShock refers to the controller and that the modification aims enhance the ease of use of the controller for quadriplegic spinal cord injury (QSCI) patients. The purpose of the study is to explore how everyday life is experienced from the point of view of QSCI patients, how leisure activities affect the Quality of Life (QoL) of QSCI patients and whether the modified PS4 DualShock impacts wellbeing of QSCI patients in Saudi Arabia.

I hope that the results will help to improve Occupational Therapists understanding of whether such modifications can enhance the QoL of a patient. Thus, leading to improving the quality of healthcare and the care that people receive on the ward. It will also offer you the opportunity to express your thoughts, feelings and experiences of the modification. If you take part in this study, I will give you the modified DualShock to use it while I'm with you in the recreational room with no one else in the room but the researcher and you (the participant) that has a PS4 device and let you try it while playing, then I will interview you about your experience of using the modification. The interviews will be audio-taped, and it is expected that each interview will last approximately 30-45 minutes.

Sincerely Yours,

Sarah Alageel

MSc Occupational Therapy Student

Cardiff University

APPENDIX 3 PARTICIPANTS INFORMATION SHEET (PIS)

PARTICIPANT INFORMATION SHEET

You are being invited to take part in a research project. Before you decide whether or not to take part, it is important for you to understand why the research is being undertaken and what it will involve. Please take time to read the following information carefully and discuss it with others, if you wish.

Thank you for reading this.

Title of study

A qualitative study exploring the impact of a modified PS4 DualShock controller created by occupational therapist on the quality of life and wellbeing of quadriplegic spinal cord Injury patients in Riyadh, Saudi Arabia

1. What is the purpose of this research project?

The purpose of the study is to explore how everyday life is experienced from the point of view of Quadriplegic Spinal Cord injury (QSCI) patients, how leisure activities affect the Quality of Life (QoL) of QSCI patients and whether a modified PS4 DualShock impacts wellbeing of QSCI patients in Saudi Arabia. The modification to the PS4 controller (DualShock) has been designed to enable patients with QSCI to grip the controller. The PS4 DualShock refers to the controller and the modification aims to enhance ease of use of the controller for quadriplegic spinal cord injury (QSCI) patients.

2. Why have I been invited to take part?

You, along with up to five other patients, were chosen from all who are Quadriplegic Spinal Cord injury (QSCI) that has an interest in gaming. Therefore, you are likely to have valuable experiences of life with a QSCI.

3. Do I have to take part?

No, participation is voluntary. You do not have to take part in this study, it is entirely up to you to decide whether or not to take part. Whether or not you decide to take part, you will be given this information sheet to keep.

If, after careful consideration, you do decide to take part, you will be asked to sign the consent to contact form and return it the OT Team Supervisor Missliah AlShehri. The researcher will then contact you so that any questions you have can be answered, if you still wish to proceed the researcher will provide you with a consent form to sign. You will be then sent a copy of your signed consent form to keep with this information sheet. Even if you do decide to take part and return the consent to contact form and the consent form, you are still free to withdraw from the study up to the point of data collection

and you do not need to give a reason. Please be assured that the decision not to take part or a decision to withdraw from the study at any time during the research will not affect the standard of care that you receive from the SCI team.

4. **Who will carry out the study?**

The study will be carried out by Sarah Alageel, an MSc Occupational Therapy student at Cardiff University.

5. **Who will monitor the study?**

The HCARE Post-Graduate Taught Research Ethics Committee at Cardiff University has approved the study. The study will be monitored and guided by Dr. Catherine Purcell, the academic research supervisor at Cardiff University.

6. What will taking part involve?

If you do decide to take part, the researcher will contact you to fix up a day and time that suits you to take part in a semi-structured interview. The interview will last between 30 and 45 minutes, and during this time you will be asked to try the modified PS4 DualShock while playing your favourite game for 15 minutes and then talk about your experiences of using it for 30 minutes. With your permission, the researcher would like to tape record our conversation. The sole purpose of tape recording the interview is for transcription and later analysis. The recording will help to analyse everybody's experiences, needs and suggestions, so that an MSc dissertation can be produced. I would like to emphasise again that you can withdraw from the research study up to data analysis, even during our meeting and conversation.

7. Will I be paid for taking part?

No

8. What are the possible benefits of taking part?

You, along with other people taking part in this research study, will enrich Occupational Therapists' knowledge about the needs, difficulties and experiences of individuals who live with a QSCI. It will also offer you the opportunity to express your feelings, thoughts and experiences on living with a disability.

9. What are the possible risks of taking part?

You may experience negative feelings or discomfort while sharing unpleasant experiences.

10. What if there is a problem?

If at any time you feel unwilling to share any experiences, you are free to discontinue. The researcher will give you time to recover if anything has caused you distress or may rearrange another session at a time which is convenient for you. However, if you feel that any negative feelings persist, you may like to seek help from your physician or your psychiatric doctor or the OT Supervisor Missliah AlShehri

If you experience any other problems related to any aspects of the study itself that cannot be resolved by the researcher, you can make a formal complaint via the Cardiff University complaints procedure. Please send a copy of your letter of complaint to:

Research Supervisor's address:

Dr Catherine Purcell

Ty Dewi Sant

Heath Park Campus

School of Healthcare Sciences Cardiff University, Cardiff, Wales

CF14 4XN

E mail: PurcellC2@cardiff.ac.uk

OR

The module leader and the Director of Research Governance:

Dr. Kate Button on 02920687734 or through email buttonk@cardiff.ac.uk at any point.

11. Will my taking part in this research project be kept confidential?

All information collected from (or about) you during the research project will be kept confidential and any personal information you provide will be managed in accordance with data protection legislation. This information will be saved and stored securely on Cardiff University server and will then be destroyed at the end of the study.

Although, with your permission, the conversation will be recorded, only the researcher and the research supervisor will have access to the tape recording and transcripts of your recording. These will be stored on a Cardiff University server and will be destroyed at the end of the research study, once the MSc dissertation has been written. No member of the SCI unit team, or anyone involved in your care, will be able to identify who has or has not taken part in the research from the final report. Your own names will not be used and no personal information about yourself will be given in the final report.
Also, you will be anonymised excerpts and/or verbatim quotes from your interview may be used as part of the research publication.

12. What will happen to my Personal Data?

Cardiff University is the Data Controller and is committed to respecting and protecting your personal data in accordance with your expectations and Data Protection legislation. Further information about Data Protection, including:

- your rights
- the legal basis under which Cardiff University processes your personal data for research
- Cardiff University's Data Protection Policy
- how to contact the Cardiff University Data Protection Officer
- how to contact the Information Commissioner's Office

may be found at https://www.cardiff.ac.uk/public-information/policies-and-procedures/data-protection and you will be given printed copies of the above information.

Finally, personally identifiable data will be destroyed at the end of the study and anonymised study data will be retained for 5 years.

13. What happens to the data at the end of the research project?

All legal and ethical guidelines will be followed to protect your confidentiality. Your identity will be protected through the use of pseudonyms and changing some of your personal details such as your age. Your consent form will be scanned into a secure electronic system before being destroyed. Audiotaping of interviews, notes and any personal information relating to you will be kept confidential between you, the researcher and the Research Supervisor. This information will be saved securely on a password-protected computer and will then be destroyed at the end of the study.

Also, demographic data will be stored anonymously using coding and to ensure further anonymity, the location of the interviews will not be fully publicized.

Anonymised excerpts and/or verbatim quotes from the interview will be used as part of the research publication.

Personal data will be retained only for the length of the study and the study data will be retained for 5 years. Data will be stored on password protected Cardiff University server.

14. What will happen to the results of the research project?

The results of the study will be submitted as a dissertation to meet a requirement of a master’s degree in Occupational Therapy for Sarah Alageel. The results of the study may also be published in an internal report or a scientific journal. You will not be identified in any report or publication as pseudonyms will be used to protect your identity at all times. At the end of the study, a copy of the results will be available and sent to your postal and/or email address.

15. Who has reviewed this research project?

This research project has been reviewed and given a favourable opinion by the School of Healthcare Sciences Research Ethics Committee at Cardiff University and SBAHC hospital approval.

16. Further information and contact details

If you have any further questions or wish further information, then please contact the researcher:

Sara Alageel

alageelSM@CARDIFF.AC.UK

I would like to take this opportunity to thank you for taking the time to read this information sheet and, whether or not you decide to take part in the research, thank you for considering it.

If you decide to participate, you will be given a copy of the Participant Information Sheet and signed consent to contact and consent form to keep for your records.

APPENDIX 4 INTERVIEW GUIDE

Appendix 4: Interview guide

Interview guide

Research question:

How does the modified PS4 DualShock created by an occupational therapist affects the well-being of quadriplegic spinal cord Injury patients?

Interview central questions:

Thinking about your experience with the modified PS4 DualShock, I would like you to tell me please about how do you think it will affect your wellbeing and QoL?

Interview follow-up questions:

1. What do you think QoL, and wellbeing means?
2. How does the spinal cord injury (SCI) affect your QoL and wellbeing?
3. How do you think this modification is beneficial and applicable?
    - How does the DualShock modification affect your motivation?
4. Do you think this modified PS4 DualShock creative and effective?

APPENDIX 5 DEBRIF SHEET

Appendix 5: Debrief Sheet

Sara Alageel
School of Healthcare
Sciences
Cardiff University
Ty Dewi Sant, Heath Park
Campus
Cardiff
CF14 4XN
Email: alageelsm@cf.ac.uk
Mobile: 00966590616111

Thank you letter to research participants

Title of the study: A qualitative study exploring the impact of a modified PS4 DualShock created by an occupational therapist on the wellbeing of quadriplegic spinal cord Injury patients in Riyadh, Saudi Arabia

Dear Mr/Mrs,

I would like to thank you for the time you spent talking with me about your valuable experience. Your experience was helpful and very informative in furthering my understanding of what is involved in living with this situation.

I hope you know how much I appreciate the interest you have shown in helping me with my research study.

Sincerely Yours,

Sarah Alageel
Researcher Occupational Therapist

School of Healthcare Sciences

Cardiff University

APPENDIX 6 PARTICIPANT TRANSCRIPTION

COMMENTARY: Fatimah is a Saudi woman. She is 26 years old and has had a career as an analyst but currently she is trying to work as a customer service. She is not married but she has a plan to do so. She had her injury in 2016 and diagnosed with Spinal Cord Injury in the level of Cervical 6.

RESEARCHER: What do you think quality of life and wellbeing means?

PATIENT: Happiness and satisfaction, being healthy and comfortable.

RESEARCHER: How does the spinal cord injury affect your quality of life and wellbeing?

PATIENT: Ever since my injury I couldn't take care of myself therefore I was relying on my family for eating, dressing, showering, almost everything. Therefore, this affected my sense of independence and wellbeing.

I think my quality of life has been affected after my injury in so many ways, for example I used to enjoy playing Playstation4 especially FIFA games, I used to play all day long, sometimes online with my friends. after my injury I tried playing once and when I found out that I couldn't reach the back buttons of the DualShock I threw it and never touched it again, somehow this made me depressed and less social.

Until now, I couldn't find a job that accepts quadriplegic people to hire, and it's depressing and makes you think of your future and financially how you will support yourself if no one is hiring you.

RESEARCHER: How does the DualShock modification affect your motivation?

PATIENT: After I have tried it, somehow, it gave me motivation to try new things and other things I thought I will never be able to do it such as riding a horse, I'm not sure how I will do that but I'm pretty sure with the help of the rehabilitation team I'll be able to do it.

RESEARCHER: How does this DualShock modification going to affect your quality of life?

PATIENT: I will be able to play again with my online friends, I will be inviting my friends to my house to play together. This modification will make me the social person I used to be.

RESEARCHER: Do you think this modified PS4 DualShock creative and effective?

PATIENT: Very much. Effective on how I can reach the buttons from the back and how it is stable while I play, I don’t have to concern about holding the DualShock while playing.

RESEARCHER: We are done. Thank you for taking part of this interview.

PATIENT: You’re welcome

[INTERVIEW ENDS]

APPENDIX 7 CONSENT FORM

CONSENT FORM

Title of research project: A qualitative study exploring the impact of a modified PS4 DualShock created by an occupational therapist on the well-being of quadriplegic spinal cord Injury patients in Riyadh, Saudi Arabia

SREC reference and committee:

Name of Chief/Principal Investigator: Sarah Alageel

Contact Details: alageelSM@CARDIFF.AC.UK

Please initial box

I confirm that I have read the information sheet dated 12 May 2021 version 01 for the above research project.	
I confirm that I have understood the information sheet dated 12 May 2021 version 01 for the above research project and that I have had the opportunity to ask questions and that these have been answered satisfactorily.	
I understand that my participation is voluntary, and I am free to withdraw at any time without giving a reason and without any adverse consequences (e.g. to medical care or legal rights, if relevant).	
I consent to the processing of my personal information [Demographic Data] for the purposes explained to me. I understand that such information will be held in accordance with all applicable data protection legislation and in strict confidence, unless disclosure is required by law or professional obligation.	
I understand who will have access to personal information provided, how the data will be stored and what will happen to the data at the end of the research project.	
I consent to being audio recorded for the purposes of the research project and I understand how this will be used in the research study.	

I understand that anonymised excerpts and/or verbatim quotes from my interview may be used as part of an MSc dissertation and potentially in a research publication.	
I understand how the findings and results of the research project will be written up and published.	
I agree to take part in this research project.	

Name of participant (print) Date Signature

Name of person taking consent (print) Date Signature

Role of person taking consent (print)

THANK YOU FOR PARTICIPATING IN THIS RESEARCH

YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP

APPENDIX 8 RISK MANAGEMENT PROTOCOL FORM

Appendix 8: Risk Management Sheet

RISK AMANGEMENT PROTOCOL

Title of the study: A QUALITATIVE STUDY EXPLORING THE IMPACT OF A MODIFIED PS4 DUALSHOCK CONTROLLER CREATED BY AN OCCUPATIONAL THERAPIST ON THE QUALITY OF LIFE AND WELLBEING OF QUADRIPLEGIC SPINAL CORD INJURY PATIENTS IN RIYADH, SAUDI ARABIA

Research on a wide range of topics can generate emotional responses and researchers need to be sensitive to research participants' feelings. This may mean monitoring participants' body language for signs of fatigue or distress and responding to such signs by suggesting that data collection be suspended or stopped. It may also mean enabling people to decline to answer particular questions or discuss specific issues.

In this study project, the participants will be reminded of their right to withdraw from research or limit their participation if they become uncomfortable, provide counseling or psychological support for those who experience distress, and thoroughly debrief with participants after research sessions are completed.

Also, the interview could be paused/stopped until the participant decides to resume it or be referred for further support to their physician or psychiatric doctor.

APPENDIX 9 ETHICAL APPROVAL

School of
Healthcare Sciences
Ysgol y Gwyddorau
Gofal Iechyd

Interim Head of School and Dean /Pennaeth yr Ysgol Dros Dro a Deon Professor David Whitaker

28 June 2021

Sarah Al Ageel

Cardiff University

School of Healthcare Sciences

Dear Sarah

Research project title: A qualitative study exploring the impact of a modified PS4 DualShock on the wellbeing of quadriplegic spinal cord Injury patients in Riyadh, Saudi Arabia

SREC reference: REC801

The School Of Healthcare Sciences Research Ethics Committee via its proportionate review process.

Ethical Opinion

The Committee gave:

a favourable ethical opinion of the above application on the basis described in the application form, protocol and supporting documentation.

Additional approvals

This letter provides an ethical opinion only. You must not start your research project until all appropriate approvals are in place.

Amendments

Any substantial amendments to documents previously reviewed by the Committee must be submitted to the Committee via HCAREethics@cardiff.ac.uk for consideration and cannot be implemented until the Committee has confirmed it is satisfied with the proposed amendments. You are permitted to implement non-substantial amendments to the documents previously reviewed by the Committee but you must provide a copy of any updated documents to the Committee via HCAREethics@cardiff.ac.uk for its records.

Monitoring requirements

The Committee must be informed of any unexpected ethical issues or unexpected adverse events that arise during the research project.

The Committee must be informed when your research project has ended. This notification should be made to HCAREethics@cardiff.ac.uk within three months of research project completion.

Complaints/Appeals

If you are dissatisfied with the decision made by the Committee, please contact the School's Research Ethics Officer, Dr Kate Button on HCAREethics@cardiff.ac.uk in the first instance to discuss your complaint. If this discussion does not resolve the issue, you are entitled to refer the matter to the Head of School for further consideration. The Head of School may refer the matter to the Open Research Integrity and Ethics Committee (ORIEC), where this is appropriate. Please be advised that ORIEC will not normally interfere with a decision of the Committee and is concerned only with the general principles of natural justice, reasonableness and fairness of the decision.

Please use the Committee reference number on all future correspondence.

The Committee reminds you that it is your responsibility to conduct your research project to the highest ethical standards and to keep all ethical issues arising from your research project under regular review.

You are expected to comply with Cardiff University's policies, procedures and guidance at all times, including, but not limited to, its Policy on the Ethical Conduct of Research involving Human Participants, Human Material or Human Data and our Research Integrity and Governance Code of Practice.

Yours sincerely,

Dr Kate Button
Director of Research Governance

Cc Dr Catherine Purcell