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# Quality of life among persons with spinal cord injury using orthoses

Marzana Shelly [1,*] Amin Ahmed [1] and Amena Rahman [2]

[1] *Department of Prosthetics and Orthotics, Bangladesh Health Professions Institute (BHPI), The Academic Institute of Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka, Bangladesh.*
[2] *Department of Occupational Therapy, Bangladesh Health Professions Institute (BHPI), Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka, Bangladesh.*

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## Abstract

**Background:** Spinal cord injury (SCI) is a life-altering condition that can significantly impair mobility, independence, and social participation. Orthotic devices are commonly prescribed to enhance postural stability, facilitate ambulation, and improve functional performance. However, evidence regarding the quality of life of individuals with SCI using orthoses in Bangladesh remains limited.

**Objective:** To assess the quality of life among persons with spinal cord injury using orthoses at a specialized rehabilitation center in Bangladesh.

**Methods:** A descriptive cross-sectional study was conducted at the Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka, Bangladesh, between May 2022 and January 2023. A total of 103 individuals with SCI who used orthotic devices were recruited through eligibility screening and written informed consent. Quality of life was assessed using the Bengali version of the Short Form-36 (SF-36) questionnaire. Data were analyzed using SPSS version 25.0, and descriptive statistics were used to summarize the findings.

**Results:** The mean age of the participants was 28.72 ± 8.82 years, and the majority were male (85.4%). Most participants perceived their general health as good or very good (74.8%), while 97.1% reported that their health status was better than one year earlier. Psychological well-being was relatively favorable, with 39.8% of participants reporting no feelings of nervousness and 41.7% indicating that they never felt extremely depressed. Physical functioning remained substantially limited, particularly in performing vigorous activities (51.5%) and bending, kneeling, or stooping (60.2%). Social functioning was comparatively well maintained, as 70.9% of participants reported that emotional problems did not interfere with their usual social activities.

**Conclusion:** Individuals with SCI using orthoses demonstrated a moderate level of quality of life. Psychological and social domains showed comparatively better outcomes than physical functioning domains, indicating successful psychosocial adaptation despite persistent physical limitations. These findings highlight the importance of comprehensive rehabilitation approaches that address both functional recovery and psychosocial well-being.

**Keywords:** Spinal cord injury; Orthoses; Quality of life; Rehabilitation; SF-36; Bangladesh.

## 1. Introduction

Spinal cord injury (SCI) is a major public health and rehabilitation challenge because it can result in permanent impairments of motor, sensory, autonomic, and psychosocial functioning. Advances in emergency care, medical

* Corresponding author: Marzana Shelly.

management, rehabilitation, assistive technologies, and environmental accessibility have transformed SCI from a frequently fatal condition into a survivable long-term disability in many high-income countries. Nevertheless, substantial disparities in outcomes remain between high-income and low- and middle-income countries (LMICs). In resource-constrained settings, delayed emergency management, limited rehabilitation services, environmental barriers, social stigma, and financial difficulties may adversely affect survival, independence, and community participation following SCI [1,2].

The epidemiology of SCI varies considerably across geographic regions and populations. Common causes include road traffic accidents, falls, occupational injuries, violence, and sports-related trauma, with their relative contributions influenced by demographic characteristics, occupational risks, and social contexts [2,3]. Beyond neurological impairment, SCI is associated with numerous secondary complications, including pain, bowel and bladder dysfunction, fatigue, reduced mobility, unemployment, and social isolation. These factors substantially influence health-related quality of life (HRQOL). Consequently, contemporary rehabilitation increasingly emphasizes not only survival and impairment management but also functional independence, social participation, autonomy, and subjective well-being [4–6].

Quality of life is a multidimensional construct encompassing physical health, psychological well-being, independence, social relationships, and participation in daily life. Individuals with SCI may experience significant physical limitations while maintaining satisfactory psychological adaptation and social integration, partly because coping mechanisms and personal expectations evolve over time [5,6]. Generic HRQOL instruments, such as the Short Form-36 (SF-36), are widely used to evaluate quality of life among persons with SCI. However, interpretation of certain physical functioning items requires caution because some activities assume normal ambulatory abilities that may not adequately reflect wheelchair- or orthosis-assisted mobility [7,8].

Orthotic devices constitute an important component of SCI rehabilitation. Orthoses may improve postural alignment, provide stability, facilitate standing and gait training, support ambulation, and enhance confidence in selected individuals. Although orthotic interventions do not reverse neurological impairment, they may contribute to improved functional independence, participation in daily activities, and social integration. Evidence regarding assistive technology suggests that appropriately prescribed devices, combined with rehabilitation interventions and environmental support, can positively influence activity performance, participation, and quality of life [9]. However, evidence regarding the quality of life of individuals with SCI who use orthoses remains limited in Bangladesh.

The need for context-specific evidence is particularly important in Bangladesh, where rehabilitation services, social support systems, environmental accessibility, and socioeconomic conditions may differ substantially from those reported in international studies. Understanding the quality of life experiences of individuals with SCI who use orthoses can assist clinicians and rehabilitation professionals in identifying domains that require additional intervention and support. Therefore, this study aimed to assess the quality of life among persons with spinal cord injury using orthoses. Specifically, the study sought to describe the sociodemographic characteristics of the participants and to evaluate their perceived physical health, psychological well-being, functional ability, ambulation, and social functioning.

## 2. Material and methods

### 2.1. Study Design and Setting

A descriptive cross-sectional study was conducted at the Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka, Bangladesh, between May 2022 and January 2023. CRP is a specialized rehabilitation center providing multidisciplinary services for individuals with spinal cord injury and other disabilities.

### 2.2. Study Participants

The study included individuals diagnosed with spinal cord injury (SCI) who were using orthotic devices and receiving follow-up services at the Prosthetics and Orthotics Department of CRP. Participants were eligible if they were able and willing to participate and could complete the interview questionnaire. Individuals with severe comorbid medical conditions, cognitive impairment, or inability to respond to the questionnaire were excluded from the study.

### 2.3. Sample Size and Sampling Procedure

The estimated sample size was 384 participants based on standard sample size calculation procedures. However, due to limitations related to study duration, participant availability, and attendance during follow-up visits, a total of 103 participants were ultimately recruited.

A list of eligible service users was obtained from the Prosthetics and Orthotics Department of CRP. Participants were initially selected using simple random sampling from the available registry. However, the final study sample consisted of individuals who attended scheduled follow-up visits and provided written informed consent. Therefore, the final recruitment process represented a pragmatic combination of random selection and convenience sampling.

### 2.4. Data Collection Instrument

Data were collected using the Short Form-36 Health Survey (SF-36), a widely used instrument for assessing health-related quality of life. The questionnaire evaluates multiple domains, including physical functioning, role limitations, bodily pain, general health, vitality, social functioning, emotional well-being, and mental health.

The SF-36 questionnaire was translated into Bengali to ensure participant comprehension. The translated version was reviewed by rehabilitation professionals to assess linguistic clarity and contextual appropriateness before data collection.

### 2.5. Data Collection Procedure

Eligible participants attending follow-up services at CRP were approached and informed about the objectives and procedures of the study. Written informed consent was obtained prior to participation. Face-to-face interviews were conducted using the Bengali version of the SF-36 questionnaire. Sociodemographic and clinical information was also collected during the interview process.

### 2.6. Data Analysis

The collected data were coded, entered, and analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistical methods were used to summarize the findings. Frequencies and percentages were calculated for categorical variables, while means, standard deviations, medians, and ranges were used for continuous variables where appropriate.

### 2.7. Ethical Considerations

Ethical approval for the study was obtained from the ethics authority of Bangladesh Open University and administrative permission was granted by the Ethics Committee of the Centre for the Rehabilitation of the Paralysed (Reference No.: CRP-R&E-0401-0409). Written informed consent was obtained from all participants prior to data collection. Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any stage without any consequences. Confidentiality and anonymity were maintained by assigning identification codes and excluding personal identifiers such as names and addresses from the dataset.

## 3. Results

Table 1 summarizes the sociodemographic characteristics and general health perceptions of the participants. The mean age of the participants was 28.72 ± 8.82 years, indicating that the study population primarily consisted of young adults. Male participants constituted the majority of the sample (85.4%), whereas females accounted for 14.6%.

Regarding health perceptions, 39.8% of participants rated their overall health as good, and more than half (53.4%) reported that their health had improved compared with one year earlier. However, nearly half of the participants (48.5%) believed that they became sick more easily than others. A substantial proportion (68.9%) reported that they were not as healthy as people they knew, while 60.2% expressed uncertainty regarding future deterioration in health status. Despite these concerns, 64.1% agreed that their health was excellent, indicating generally positive self-perceptions of health among the participants.

**Table 1** Participant Characteristics and General Health Perceptions Among Persons with Spinal Cord Injury Using Orthotic Devices (n = 103)

| Domain | Variable/Item | Response/Statistic | n | % |
|---|---|---|---|---|
| Sociodemographic Characteristics | Age, mean ± SD | 28.72 ± 8.82 years | — | — |
| | Median age (range) | 28 years (11–55) | — | — |
| | Male | — | 88 | 85.4 |
| | Female | — | 15 | 14.6 |
| General Health Perceptions | General health rating | Good | 41 | 39.8 |
| | Health compared with one year earlier | Somewhat better | 55 | 53.4 |
| | Gets sick easier than others | Mostly true | 50 | 48.5 |
| | As healthy as anybody known | Mostly false | 71 | 68.9 |
| | Expect health to get worse | Do not know | 62 | 60.2 |
| | My health is excellent | Mostly true | 66 | 64.1 |

Source: Present study data.
Abbreviation: SD = standard deviation.

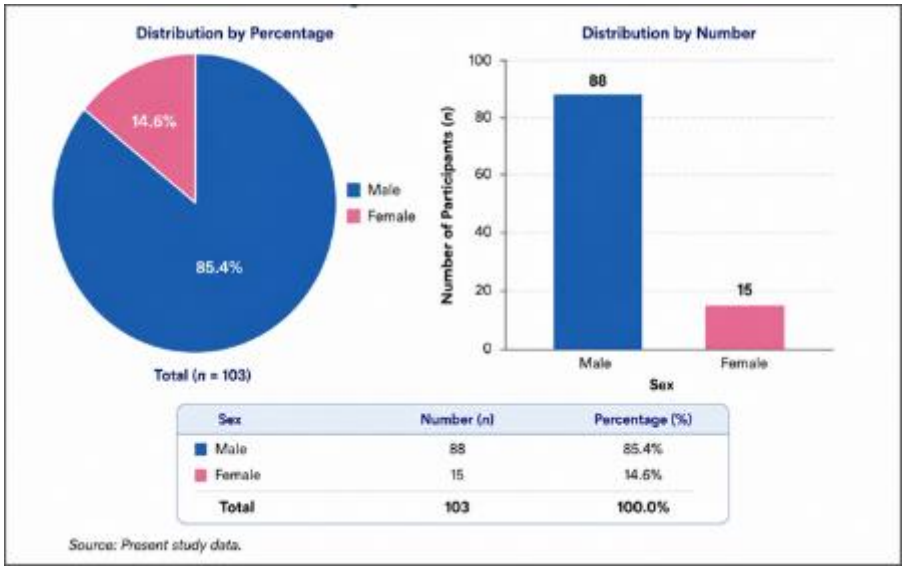


**Figure 1** Sex distribution of participants with spinal cord injury using orthotic devices. The study population was predominantly male, accounting for 85.4% of participants

**Figure 1** illustrates the sex distribution of participants with spinal cord injury using orthotic devices. The majority of participants were male (85.4%), whereas females constituted 14.6% of the sample. The findings indicate a marked predominance of male participants within the study population. The predominance of male participants shown in Figure 1 is consistent with the epidemiological pattern of spinal cord injury reported worldwide. Young adult males are generally at greater risk of traumatic SCI because of increased exposure to occupational hazards, road traffic accidents, and falls. This demographic pattern has important social and economic implications, as SCI occurring during productive years may adversely affect employment, family responsibilities, and community participation.

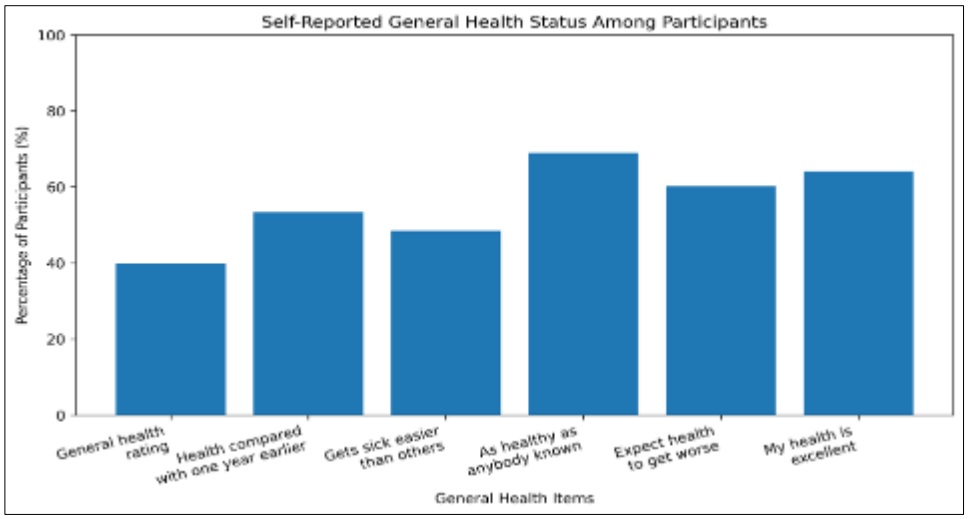


**Figure 2** Self-reported general health status among persons with spinal cord injury using orthotic devices (n = 103).

Figure 2**.** Distribution of the most frequently reported responses for general health perception items. Participants generally reported positive health perceptions and improvement in health status compared with the previous year. However, concerns regarding vulnerability to illness and uncertainty about future health remained common.

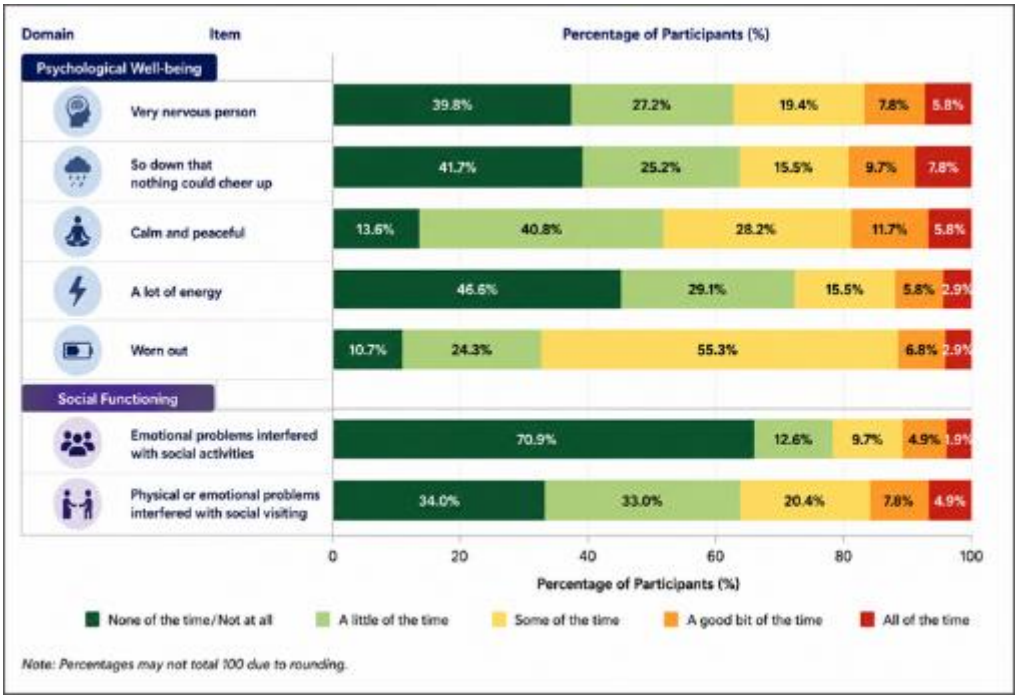


**Figure 3** Psychological and Social Functioning Responses Among Participants (n = 103)

Figure 3 illustrates the psychological and social functioning responses among persons with spinal cord injury using orthotic devices. Most participants reported favorable psychological well-being. Approximately 39.8% of participants reported feeling nervous none of the time, while 41.7% reported that they never felt so depressed that nothing could cheer them up. Feelings of calmness and emotional stability were commonly reported, with 40.8% indicating that they felt calm and peaceful a good bit of the time.

Perceived energy levels were relatively positive, as 46.6% of participants reported having a lot of energy all of the time. However, fatigue remained a common concern, with 55.3% reporting feeling worn out some of the time.

Social functioning was generally preserved. The majority of participants (70.9%) reported that emotional problems did not interfere with their social activities. Furthermore, 34.0% indicated that physical or emotional problems never interfered with social visits.

Overall, Figure 3 demonstrates that psychological well-being and social participation were relatively well maintained among participants despite the presence of spinal cord injury and physical limitations. Nevertheless, fatigue and occasional emotional difficulties remained evident in a proportion of participants.

**Table 2** Physical functioning and ambulation responses (n = 103).

| Activity | Most frequent response | n | % | Key point |
|---|---|---|---|---|
| Vigorous activities | Limited a lot | 53 | 51.5 | High-level activity was most restricted |
| Moderate activities | Limited a little | 59 | 57.3 | Moderate activity showed partial limitation |
| Lifting/carrying groceries | Limited a lot | 53 | 51.5 | Carrying tasks remained difficult |
| Climbing several flights of stairs | Limited a little | 59 | 57.3 | Stair endurance was partly limited |
| Climbing one flight of stairs | Not limited at all | 73 | 70.9 | Short stair task was often possible |
| Bending/kneeling/stooping | Limited a lot | 62 | 60.2 | Postural task was highly restricted |
| Walking more than one mile | Limited a little | 40 | 38.8 | Long-distance mobility varied |
| Walking several blocks | Limited a little | 58 | 56.3 | Community-distance walking was partly limited |
| Walking one block | Not limited at all | 99 | 96.1 | Short-distance ambulation was mostly preserved |
| Bathing or dressing | Not limited at all | 77 | 74.8 | Basic self-care was mostly independent |

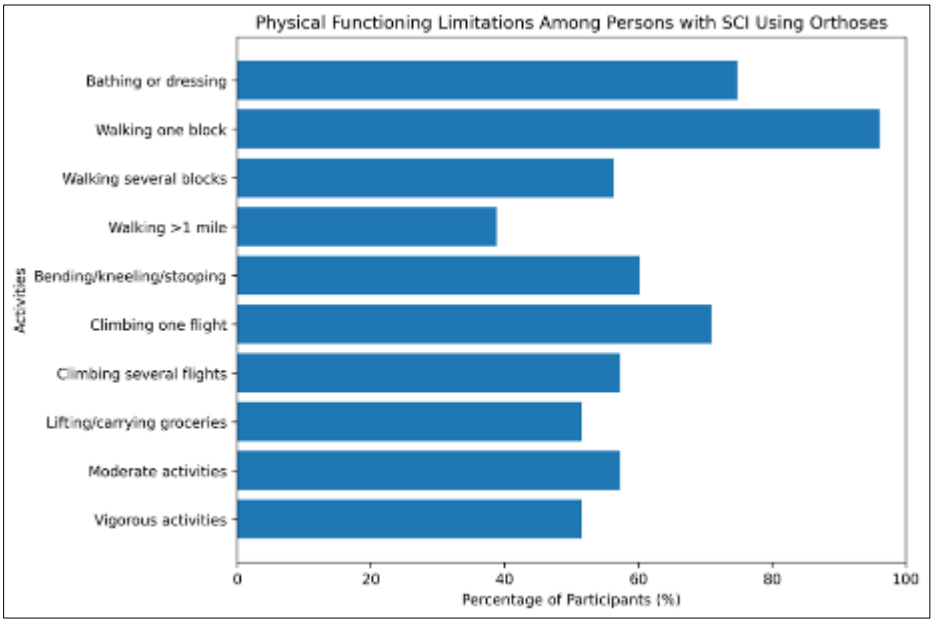


**Figure 4** Physical functioning limitations among persons with spinal cord injury using orthotic devices.

The figure illustrates the proportion of participants reporting activity limitations across various physical tasks. Higher levels of limitation were observed for vigorous activities, bending or kneeling, lifting and carrying objects, and long-

distance mobility, whereas most participants reported little or no limitation in short-distance walking and basic self-care activities.

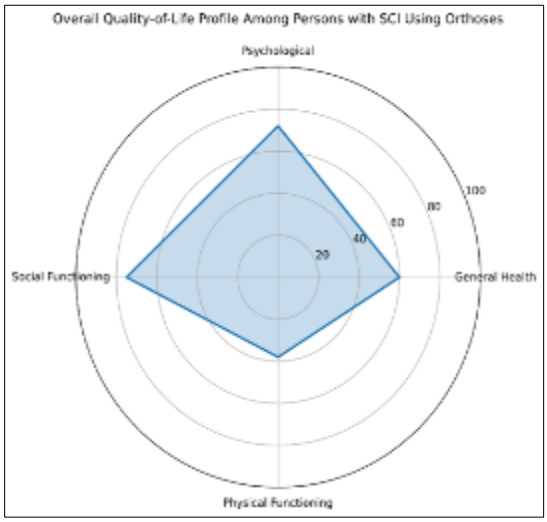


**Figure 5** Overall quality-of-life profile among persons with spinal cord injury using orthotic devices.

The radar chart illustrates the relative pattern of health-related quality of life domains, showing comparatively higher psychological and social functioning, moderate general health perception, and lower physical functioning among participants.

## 4. Discussion

This study demonstrated that persons with spinal cord injury (SCI) using orthotic devices at CRP exhibited a moderate quality-of-life profile characterized by relatively preserved psychological and social well-being but persistent limitations in physical functioning. The predominance of young adult males in the sample is consistent with the epidemiological pattern of SCI reported globally, where traumatic injuries frequently occur among economically productive men exposed to road traffic accidents, occupational hazards, and falls. Injury during early adulthood may substantially disrupt educational attainment, employment opportunities, family responsibilities, and economic independence, thereby influencing long-term quality of life and social participation [2,3].

Most participants perceived their general health as good or very good and reported improvement in health status compared with the previous year. This finding may reflect the beneficial effects of rehabilitation services, orthotic intervention, adaptation to disability, and increased self-management abilities. However, many participants also reported feeling more susceptible to illness and less healthy than their peers. Such findings indicate that subjective health perceptions remain complex following SCI. Previous studies have demonstrated that perceived health, functional ability, and overall quality of life represent distinct yet interrelated constructs, and improvements in physical function do not necessarily eliminate perceptions of vulnerability or reduced health status [4–6].

The psychological findings were generally favorable. Many participants reported minimal nervousness, limited depressive symptoms, and feelings of calmness, happiness, and vitality. These results are consistent with previous evidence suggesting that individuals with SCI often demonstrate considerable psychological adaptation over time, particularly when rehabilitation services, family support, and opportunities for meaningful engagement are available. Psychosocial adjustment has been recognized as an important determinant of long-term quality of life following SCI [5,10]. Nevertheless, some participants experienced fatigue and occasional emotional difficulties, indicating the need for continuous psychological assessment and psychosocial support throughout rehabilitation.

Physical functioning emerged as the most restricted domain. Participants reported substantial limitations in vigorous activities, bending, kneeling, stooping, carrying objects, and long-distance ambulation. These findings are expected because SCI directly impairs motor function, endurance, balance, and mobility capacity. Previous studies utilizing the SF-36 among individuals with SCI similarly reported lower scores in physical functioning and role-physical domains compared with mental health and social functioning domains [7,8]. Despite these limitations, many participants retained the ability to perform basic self-care activities such as bathing and dressing and were capable of walking short

distances. These findings suggest that orthotic devices may contribute to maintaining functional independence in daily activities, even when higher-level mobility remains compromised.

Social functioning was comparatively well preserved. Most participants reported that emotional problems did not substantially interfere with social activities, although a subgroup experienced occasional restrictions due to physical or emotional difficulties. International evidence indicates that participation and quality of life following SCI are strongly influenced by environmental, cultural, and social factors. Access to rehabilitation services, family support, social inclusion, and environmental accessibility all contribute to participation outcomes [10]. Within the Bangladeshi context, strong family support networks may facilitate social integration, whereas environmental barriers, inaccessible transportation systems, financial constraints, and limited community accessibility may continue to restrict broader participation.

The role of assistive technology extends beyond physical mobility alone. Previous research has demonstrated that orthotic devices improve participation and independence only when accompanied by appropriate training, follow-up services, maintenance, and supportive environmental conditions. Device provision without adequate user education or environmental accessibility may limit the potential benefits of orthotic intervention [9]. Therefore, successful orthotic rehabilitation requires a comprehensive approach that addresses both individual and environmental factors.

### 4.1. Practice Implications

The findings of this study have several implications for rehabilitation practice. First, orthotic intervention should not be evaluated solely based on device provision or the ability to achieve standing or walking. Rehabilitation professionals should incorporate patient-reported outcome measures, functional performance, fatigue, social participation, comfort, and user satisfaction into routine follow-up assessments. Comprehensive evaluation may provide a more accurate understanding of rehabilitation outcomes and patient needs [11].

Second, rehabilitation goals should be individualized according to the priorities and life circumstances of each person with SCI. For some individuals, safe household mobility may represent a meaningful outcome, whereas others may prioritize community ambulation, employment, social participation, or improved self-confidence. Previous studies have shown that recovery priorities differ according to injury characteristics, functional status, and personal goals, emphasizing the importance of client-centered rehabilitation approaches [11].

Third, routine psychological screening should be incorporated into SCI rehabilitation programs. Although many participants demonstrated positive psychological adjustment, emotional distress, fatigue, and coping difficulties remained present among some individuals. Early identification of psychological concerns may improve long-term adjustment, participation, and quality of life outcomes [5,10].

Finally, the findings support the integration of generic quality-of-life instruments with SCI-specific clinical indicators. Although the SF-36 provided valuable information regarding physical, psychological, and social health dimensions, future evaluations should include neurological level, American Spinal Injury Association (ASIA) impairment grade, duration of injury, orthosis type, duration of orthosis use, secondary complications, and employment status. Such comprehensive assessment would facilitate identification of modifiable factors associated with improved quality of life outcomes [12,13].

### *Limitations*

Several limitations should be acknowledged. First, the study was conducted at a single rehabilitation center, which may limit the generalizability of the findings to the broader SCI population in Bangladesh. Second, the achieved sample size was smaller than the calculated sample size, and convenience sampling may have introduced selection bias. Third, the cross-sectional design precludes determination of causal relationships between orthotic use and quality of life outcomes. Fourth, the findings relied on self-reported responses and item-level analysis of the SF-36 rather than complete norm-based domain scoring. Finally, important clinical variables, including neurological level, injury completeness, duration of injury, orthotic type, and secondary complications, were not examined in detail. Future studies should employ larger multicenter samples, longitudinal designs, and comprehensive clinical assessments to better understand the determinants of quality of life among individuals with SCI using orthotic devices.

## 5. Conclusion

Persons with spinal cord injury using orthotic devices demonstrated a moderate quality of life characterized by relatively favorable psychological adaptation and social functioning but persistent limitations in physical functioning and higher-level mobility activities. These findings emphasize the importance of comprehensive rehabilitation programs that integrate orthotic management with mobility training, prevention of secondary complications, psychological support, family education, and community participation interventions. Further longitudinal and multicenter studies are needed to clarify the relationships among orthotic use, injury characteristics, environmental factors, and quality of life outcomes among persons with SCI in Bangladesh.

## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The author declares no conflict of interest.

### *Statement of ethical approval*

Ethical approval and permission were obtained from the Bangladesh Open University and the Ethics Committee of the Centre for the Rehabilitation of the Paralysed in Savar, Dhaka. Reference number: CRP-R&E-0401-0409

### *Statement of informed consent*

Informed consent was obtained from all subjects involved in the study.

### *Funding*

No specific funding was received for this study.

### *Data Availability*

The anonymized data supporting the findings of this study may be available from the corresponding author upon reasonable request and with appropriate institutional permission.

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