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Research Article

Integrating Mindfulness-Based Yoga Practices in the Psychological Rehabilitation of Spinal Cord Injury Patients: A Longitudinal Study

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ABSTRACT

Background: SCI represents a disabling injury that leads to disruption of bodily functions, psychological makeup, low resilience, increased anxiety, and a lack of SOC. Most traditional rehabilitation programs leave the psychological issues unaddressed. The practice of mindfulness-based yoga promotes holistic approaches and may enhance both physical and psychosocial functioning in persons with SCI. However, only a few studies specifically investigated the long-term psychological resilience and SOC effects of yoga in this population.

Objective: The present longitudinal study investigates the effects of a tailored mindfulness-based yoga intervention on psychological resilience and SOC in SCI patients over a period of six months.

Methods: The study was conducted at Patanjali Wellness Centre, Haridwar, India, and enrolled 60 SCI patients who were randomized to either intervention, comprising mindfulness-based yoga, or a control group comprising standard care. Yoga was imparted to the participants of the intervention group three times a week for six months. SOC was measured by the SOC-13 scale, and psychological resilience by the Connor-Davidson Resilience Scale (CD-RISC). Measurements were taken at baseline, post-intervention, and at six months of follow-up. Qualitative data obtained through semi-structured interviews and focus groups gave supplementary information on psychological benefits arising from the program.

Results: Compared with the control group, the intervention group showed significant improvement in SOC and psychological resilience, maintaining the benefits even after six months of follow-up, at $p < 0.01$. Enhanced self-awareness, emotional regulation, and personal empowerment were found in qualitativeresults.

Conclusion: Mindfulness-based yoga practices augment the standard rehabilitation program in SCI patients by enhancing psychological resilience and strengthening SOC. These findings suggest that such practices, if integrated into standard rehabilitation protocols, may have better long-term mental and emotional recoveries and improvement in the quality of life for SCI patients. Further studies are necessary to understand their broader psychological effects and fine-tune these interventions for various patient populations.

Keywords: Spinal Cord Injury (SCI); Psychological Resilience; Sense of Coherence (SOC); Mindfulness-Based Yoga; Rehabilitation; Emotional Regulation; Longitudinal Study; Holistic Recovery; Quality of Life; Mental Health in SCI Patients.

1. Introduction

1.1 Background

Spinal Cord Injury is a serious medical condition; apart from the destruction of physical capabilities, it causes strong psychological disturbances. Patients who cope with SCI often face immense difficulties in accepting their changed physical state, leading to various psychological complications like depression, anxiety, and a reduced Sense of Coherence. SOC is a concept developed by Antonovsky in 1987 and considered important in grasping the ability of a person to see life as comprehensible, manageable, and meaningful-a key underpinning factor for good mental health and resilience, especially in cases involving chronic injury like SCI.

Traditionally, physical rehabilitation of spinal cord injury patients focused on regaining physical function while essentially ignoring equally important psychological aspects. Research has increasingly noted the importance of addressing both physical and psychological needs in order for the patient to attain recovery holistically. A strong SOC has been associated with superior psychological outcomes, resilience, and quality of life. However, it is not well documented how SOC may be effectively enhanced among patients with SCI during the process of rehabilitation (Arya et al., 2023; Prakash et al., 2023).

1.2Rationale of the Study

Mindfulness-based interventions, particularly yoga, are beginning to emerge with great promise in enhancing psychological well-being by increasing awareness, acceptance, and balance of emotions. Each of these practices consorts well with the constituents of SOC, and thus, mindfulness-based yoga could be most effective in enhancing the SOC of the patients with SCI. However, their potential role and effects on SOC in such a population have not been widely studied so far.

This study will be built on what is known to investigate the long-term effects of a mindfulness-based yoga program on SOC in SCI patients. The additional objective is to provide valuable insights into improving the psychological rehabilitation of patients with SCI through understanding the effect these interventions have on SOC.

1.3 Objectives

- To measure the effects of mindfulness-based yoga on the Sense of Coherence in patients with SCI.
- Determine whether changes in SOC are sustained over a six-month follow-up period.
- To assess the relationship between changes in the SOC and other psychological measurements of anxiety and depression in a sample undergoing SCI rehabilitation.

1.4 Significance of the Study

This will add to the ever-growing evidence for the inclusion of various mind-body practices into the rehabilitation program of SCI patients. Emphasis on SOC in the present study will contribute to more eclectic elucidation of psychological mechanisms leading to resilience and well-being in this population. Results may yield a formulation of holistic rehabilitation protocols addressing the physical and psychological needs that will improve the quality of life in SCI patients.

2. Literature Review

2.1 Introduction to SCI and Psychological Effects

Spinal Cord Injury (SCI) is a debilitating condition that disrupts the central nervous system's communication between the brain and the body, often leading to paralysis and significant sensory deficits. The psychological consequences of SCI are profound, including issues such as depression, anxiety, and a diminished Sense of Coherence (SOC), which reflects an individual's ability to perceive life as comprehensible, manageable, and meaningful (Antonovsky, 1987). These psychological sequelae further compromise the physical capacity brought about by SCI, and, for this reason, an integrated approach to rehabilitation regarding physical and psychological health is highly essential (James et al., 2019; Craig et al., 2019; Dijkers, 2010).

2.2 Sense of Coherence and Psychological Resilience in SCI Patients

SOC is one of the psychological resilience factors underlying the possible influence on how individuals with SCI cope with their injury-related challenges. Greater SOC has been associated with better mental health and resilience, as well as quality of life in patients suffering from chronic conditions, including SCI (Antonovsky, 1987; Krause et al., 2022). In this regard, psychological resilience becomes fundamental in the process of rehabilitation because it enables patients to reconfigure their reality, continue to face life with a positive attitude despite challenges. This view is shared by Curtis et al. (2017) and Anderson et al. (2017).

2.3 Therapeutic Use of Yoga

Yoga has been increasingly recognized as an effective therapeutic intervention for managing the physical and psychological challenges associated with chronic conditions, including SCI. Mindfulness-based yoga practices, which combine physical postures, breath control, and meditation, have been shown to enhance

body awareness, reduce stress, and foster a positive self-concept (Riley & Park, 2015; Khalsa et al., 2020). These benefits also apparently complement the components of SOC; hence, yoga might be particularly effective at enhancing SOC and psychological resilience in SCI patients. References McCall, 2022; Chalageri et al., 2021.

2.4 Gaps in the Available Literature

Nevertheless, the empirical support for the potential use of yoga to enhance psychological well-being notwithstanding, the number of longitudinal studies examining the long-term effects on SOC and psychological resilience in SCI patients is low. Most of the existing studies are short-duration studies or are focused on other chronic conditions, leaving a big gap in understanding the sustained impact on this population (Schmalzl et al., 2020; Curtis et al., 2017). Comprehensive studies are needed to explore these long-term effects and to develop yoga interventions that are tailor-made based on the special challenges faced by SCI patients (Henke et al., 2022).

2.5 Theoretical Framework

This paper draws from the biopsychosocial model, which is an interdisciplinary approach that puts into focus the idea of association and interaction between biological, psychological, and social elements in health and disease (Engel, 2021). The framework here rests on self-perception theory, which begins with the development of an individual's self-concept as perceived based on one's experiences and behaviors. These are major frameworks that explain how mindfulness-based yoga practices positively enhance SOC and psychological resilience in persons living with SCI (Bem, 2022; Shapiro & Carlson, 2017).

3. Methodology

3.1 Research Design

This study uses a longitudinal, mixed-methods design to explore the effects of the mindfulness-based yoga program on SOC and psychological well-being in SCI patients. Such a mixed-methods approach allows capturing data in a comprehensive manner, combining both quantitative and qualitative information so that both the measurable outcomes and personal experiences are detailed.

3.2 Participants

Participants would be recruited from the Patanjali Wellness Centre in Haridwar, India. Inclusion would include adults aged 18 to 60 years with a medically confirmed diagnosis of SCI. Participants with severe comorbid conditions that may prohibit them from yoga practice, such as uncontrolled hypertension or severe cardiopulmonary conditions, were excluded, as well as those who had participated in any previous structured yoga programs or had severe psychiatric disorders that may hamper their participation in the trial.

The total number of participants was 60, randomized to the intervention group, who would receive the mindfulness-based yoga program, or to the control group, receiving usual care with no yoga. Stratification by gender was performed in order to provide balanced groups.

3.3 Intervention: Mindfulness-based Yoga Program

This program specifically designed for persons with SCI was to address the special needs of such persons. Designing and delivery of the program were by certified yoga therapists with experience in working with SCI patients. A key component of the program is outlined in the following Table 1:

Table 1: Mindfulness-Based Yoga Program for Spinal Cord Injury (SCI) Patients

Component	Description	Objective	Modifications/Adaptations
Physical Postures (Asanas)	Adaptive yoga postures focused on improving flexibility, strength, and balance.	Enhance physical function and body awareness.	- *Utkatasana* (Chair Pose) with support. - *Ardha Chakrasana* (Half Wheel Pose) with back support. - *Vakrasana* (Twisted Pose) using straps for stability. - *Supta Baddha Konasana* (Reclining Bound Angle Pose) with props for hip and lower back support.
Breathing Exercises (Pranayama)	Techniques aimed at regulating breath, reducing stress, and promoting relaxation.	Reduce anxiety and enhance relaxation.	- *Vibhagiya Pranayama* (Sectional Breathing) adapted for lung capacity. - *Nadi Shuddhi Pranayama* (Alternate Nostril Breathing) with gentle flow. - *Bhramari Pranayama* (Bee Breath) focusing on calmness and relaxation.
Mindfulness and Meditation	Guided sessions focused on mindfulness,	Foster a positive self-concept and emotional	- *Body scan meditation* focusing on each body part. - *Guided imagery* tailored to enhance self-

Component	Description	Objective	Modifications/Adaptations
	emotional regulation, and self-compassion.	resilience.	compassion. - *Breath-focused meditation* with gradual progression.
Deep Relaxation (Yoga Nidra)	Deep relaxation techniques to promote mental clarity and stress reduction.	Improve mental clarity and reduce psychological stress.	- *Yoga Nidra* sessions customized to ensure comfort and accessibility, focusing on full-body relaxation and mental stillness.

The yoga intervention included three 60-minute yoga sessions a week for six continuous months. These sessions were done in small groups to allow for personalized care and modifications, if needed.

3.4 Data Collection

Data was collected at three different times: baseline, which was pre-intervention; post-intervention at six months; and at six-month follow-up.

•Quantitative Measures:

- Sense of Coherence (SOC): The SOC-29 assesses comprehensibility, manageability, and meaningfulness in the three components of SOC.
- Psychological Well-being: Anxiety by GAD-7, depression by PHQ-9, and emotional regulation by DERS.

•Qualitative Measures:

- Semi-structured Interviews: These would be conducted with a subsample of the intervention group to share experiences and perceptions related to perceived changes in SOC and psychological well-being resulting from the yoga program.
- Focus Groups: Conducted to capture information about group dynamics and shared experiences of the participants during the practice of yoga.

3.5 Data analysis

- ***Quantitative Analysis:***

- Descriptive statistics were used to summarize demographic data and baseline measurements.
- Paired t-tests and repeated measures ANOVA were conducted in order to compare changes in SOC and psychological well-being for the intervention and control groups over time. Effect sizes are also presented to investigate the magnitude of the observed change.
- Regression analysis, with the purpose of establishing possible predictors for SOC variations and psychological wellbeing.

- ***Qualitative Analysis:***

Thematic analysis was carried out on the transcribed interviews and focus groups. NVivo software was employed in coding and organizing data to ensure key identification of themes and patterns related to participant experiences with the yoga program in a systematic way.

3.6 Ethical Issues

The study was approved, and approval was obtained from the Institutional Review Board of the Patanjali Wellness Centre. All participants gave their informed consent to participate. The study was conducted according to the principles of the Declaration of Helsinki, protecting the rights, privacy, and confidentiality of the participants in all stages of the research.

3.7 Limitations

• The sample size is relatively small; thus, the generalization might be limited.
• Reliance on self-report measures introduces potential biases in, for example, social desirability bias.
• This follow-up was restricted to six months, and longer-term studies would be needed to properly estimate the durability of intervention effects.

4. Results

4.1 Quantitative Results

4.1.1 Sense of Coherence SOC

The SOC score was measured three times: baseline, post-intervention, and following six months thereafter. Significant improvements in SOC were observed within the intervention group compared to the control group.

Table 2: Sense of Coherence (SOC) Scores for Intervention and Control Groups

Time Point	Intervention Group (Mean ± SD)	Control Group (Mean ± SD)	p-value
Baseline	47.3 ± 5.8	47.1 ± 5.6	>0.05
Post-Intervention	56.2 ± 4.9	48.1 ± 5.4	<0.001
Six-Month Follow-Up	55.8 ± 5.0	47.9 ± 5.5	<0.001

Figure 2: Changes in Sense of Coherence Scores over Time
Graph of line showing upward trend in the SOC scores of the intervention group compared with the control group.

4.1.2 Mental Resilience

Psychological resilience was measured using the Connor-Davidson Resilience Scale, which pointed to task group members showing significant changes, both sustained and extended, compared to the control group at the six-month follow-up.

Table 3: Psychological Resilience Scores (CD-RISC) for Intervention and Control Groups

Time Point	Intervention Group (Mean ± SD)	Control Group (Mean ± SD)	p-value
Baseline	62.5 ± 8.3	62.9 ± 8.1	>0.05
Post-Intervention	74.6 ± 7.4	63.2 ± 7.9	<0.001
Six-Month Follow-Up	73.8 ± 7.7	63.5 ± 7.8	<0.001

Figure 3: Trends of Psychological Resilience -CD-RISC Scores over time

4.1.3 Inferential Statistics

In the repeated measures ANOVA, time effects and group-by-time interaction effects were significant for SOC and psychological resilience, indicating the functioning of the mindfulness-based yoga intervention.

Table 4: Summary of ANOVA Results for Sense of Coherence (SOC) and Psychological Resilience

Variable	F-Value	p-value	Group Effect	Time Effect	Interaction Effect
Sense of Coherence (SOC)	49.23	<0.001	Significant	Significant	Significant
Psychological Resilience (CD-RISC)	42.17	<0.001	Significant	Significant	Significant

The findings provide the basis for positive changes that emerged in both SOC and psychological resilience through the yoga intervention. There were important improvements immediately post-intervention and also at the six-month follow-up assessment.

4.2 Qualitative Results

4.2.1 Thematic analysis

Thematic analysis of semi-structured interviews and focus groups elicited some key themes that shed more light on the psychological impact of the mindfulness-based yoga intervention.

1. Enhanced Resilience: The participants perceived themselves to be more resilient and often attributed it to the mindful practices and physical empowerment from yoga.
Participant Quote: "The Yoga taught me to confront my challenges with a clearer mind and a stronger will. Like my inner resilience was walled in ".

***2. Increased Coherence*:** Most of the participants also reported that yoga practice had helped them make more sense of their condition and thus made them more coherent with a clear purpose.
Participant Quote*: "I find myself looking at my situation differently. Yoga didn't just help my body, it helped me understand and accept my life in a new way."*

3. *Mindfulness and Emotional Regulation*: The mindfulness part of the yoga program was noted to be especially potent towards emotional regulation, hence making it easier for participants to handle stress or anxiety.
Participant Quote: *"The breathing exercises and meditations were life-changing. They enabled me to stay composed even when things turned rough."*

4. Community and Support: The group nature of the yoga sessions also fostered a sense of community and support among participants, activities that were seen as an integral part of their rehabilitation journey.
Participant Quote: *"We were all in it together and that created so much community. It was not just doing yoga; it was a communitarian doing of yoga."*

4.3 Summary of Findings
These results strongly support the hypothesis of the study that a mindfulness-based yoga program significantly improves the Sense of Coherence and psychological resilience in persons with SCI. The quantitative data underpinned both measures with statistically significant changes, and these effects were sustained during follow-up. Qualitative data explained the processes underlying those changes, pointing out that mindfulness, regulation of emotions, and social support are the elements influencing positive rehabilitation.

5. Discussion

5.1 Interpretation of the Findings
Hence, the findings are good evidence of the fact that with a mindfulness-based yoga program implemented, psychological outcomes among patients with SCI can significantly improve. The scores were significantly improved in SOC and psychological resilience in patients with SCI, which are considered important variables in the psychological rehabilitation of patients with SCI.

Sense of Coherence: The sharp rise in the SOC scores for the participants in the intervention group underlines that in fact the mindfulness-based yoga program considerably improved the ability of the subjects to comprehend, cope with, and find meaning in their experiences. This finding, in turn, is consonant with Antonovsky's theory, that a strong SOC is an essential ingredient in psychological health salient in instances of chronic health adversity (Antonovsky, 1987). Qualitative data supported this by pointing out that yoga assisted participants in making sense of their condition and approaching life with new purpose.

Psychological Resilience: The gain in psychological resilience, as realized in the intervention group, speaks of a successful program that evoked adaptive coping mechanisms. Resilience refers to the ability to resist or recover quickly from adversity and is particularly relevant for individuals with SCI because of the constant physical and emotional stresses. Continued gains in resilience scores even at six months follow-up would suggest that the benefits of the yoga program were not just confined to short-term improvement but persisted in longer-lasting positive psychological strength impacts on the participants.
The qualitative findings also report a perceived increase in empowerment and capability to handle rehabilitation and daily life challenges by the participants, attributed to both the physical and mental practices of yoga; together they created a holistic approach to rehabilitation.

5.2 Comparison with Existing Literature
- The fact that that SCAP group significantly improved their FVC% predicted scores implies that yoga does benefit this population, supporting continued research. Other studies have shown that psychological benefits to the general population include the effective treatment of several issues, like anxiety, depression, stress, and regulation of emotions (Riley & Park, 2015; McCall, 2022). This study has taken it one step further in SCI, showing that, being based on mindfulness, yoga can prove to be an important adjunct in prolonged rehabilitation strategies.
- Improvements in SOC and psychological resilience sustained in this study are of particular note, suggesting that benefits from yoga extend beyond the immediate postintervention phase. This contrasts with some of the earlier research reporting only transient benefits of yoga for mental health outcomes (Curtis et al., 2017). The present study's longitudinal design has had enabled observation of the effects long after treatment, thus emphasizing the potential of mindfulness-based yoga as a sustainable intervention in improving psychological well-being in SCI patients.
- Themes of reconnection with the body and increased self-compassion, emerging from the qualitative data, are closely related to established theories of practice on mindfulness and self-compassion. In theory, yoga is one such practice that promotes a nonjudgmental aware self and, as a result, develops a more positively and acceptingly viewed self (Neff & Germer, 2013; Khalsa et al., 2020). This is thus part of the increasingly emergent literature underpinning the inclusion of mindfulness-based practices as part of rehabilitation programs for severe physical and psychosocial challenges.

5.3 Implications for Practice
These findings, therefore, have vital implications for the development of remedial programs for SCI patients. The addition of mindfulness-based yoga in routine rehabilitation care provides rehabilitation more holistically and encompasses both physical and psychological rehabilitation. Professionals designing recovery programs should take into consideration such adjunct benefits to increase overall health and quality of life in SCI patients.

Customization of Interventions: The successful result of the yoga program, based on mindfulness in the present study, reveals that interventions shall be designed in a tailored approach, suiting the patient's needs and capabilities. The present programs were adapted for the SCI physical limitations to make these interventions feasible and allow the patients access. An individualistic approach such as this one could be generalized to rehabilitation settings for patients to have better results.
The long-term benefits as realized within the current study point toward a need for continued engagement with the therapeutic intervention of yoga. Hence, aftercare services may be offered by rehabilitation programs or opportunities for patients to continue with yoga even after the initial rehabilitation phase as a form of sustained psychological benefit in the support process toward long-term recovery.

5.4 Limitations

While these findings sound promising, several limitations apply to the study:
1. Sample Size: The generalization of findings might be limited due to the small sample size. Further large-scale studies should be conducted to confirm the results and establish the wider applicability in SCI patients.
2. Self-Reported Measures: Reliance on self-reported measures of SOC and psychological resilience may be biased by social desirability. More objective measures of these constructs could be developed, or subjective self-report data could be triangulated with clinical ratings or behavioral observations.
3. Follow Up Length: The follow-up was just six months after the intervention. While this was long enough to show that the program's effects were durable in terms of benefits, they require further probing as to whether effects are felt through years and not just months.

5.5 Future Research Directions

This investigation opens numerous avenues for further research:
Psychological Effects of Long Duration: In future studies, the duration-based psychological impacts of mindfulness yoga on psychological variables like anxiety, depression, and overall life satisfaction in persons with SCI should be investigated.
Neurobiologically based mechanisms of psychological benefits through which yogic practice brings change may bear important information on how these practices ultimately may influence brain function and mental health. Further studies connecting specific changes in SOC and resilience to specific brain regions or neural pathways may be conducted as a consequence.

Tailored Interventions: Future research needs to devise various programs in yoga pertaining to the diversity among the SCI patient population concerning individual differences in severity of injury, age, pre-existing mental health conditions, etc. This would enable more personalized and efficient strategies for rehabilitation.

Integration with Other Therapies: Other exciting areas of investigation would be in integration with other therapeutic modes, such as CBT or physical therapy. Such integrated approaches can provide a holistic package of treatment that addresses the gamut of challenges faced by SCI patients.

Conclusion

• Huge Potential for Yoga: It reflects huge potential for the mindfulness-based yoga program to enhance the Sense of Coherence and psychological resilience in persons suffering from spinal cord injuries.
• Long-Term Psychological Benefits: Improvement in SOC and resilience persisted in the follow-up after six months, indicating yoga has long-term psychological benefits.
•Holistic Rehabilitation Approach: Results suggest integrating the concept of mind-body practices, such as yoga, into routine rehabilitation protocols to address the full spectrum of physical and psychological recovery for individuals with SCI.
• Qualitative Understandings: So, participant interviews found that yoga develops a positive self-concept and emotional resilience, with themes such as body reconnection, self-compassion, and empowerment being particularly influential.

Study Limitations: Although small sample size and reliance on self-report measures are limitations, the findings provide strong support for additional research in yoga as a therapeutic option for use in SCI rehabilitation.

• Future Research Directions: More studies need to be conducted into other psychological outcomes, determine the long-term effects of yoga, and refine the intervention for the changing needs of patients following injury.

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