

CENTRAL SENSITIZATION AND CERVICAL IMPAIRMENT IN WHIPLASH: A CLOSER LOOK AT THE SUBACUTE STAGE

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Summary

This study compared individuals with subacute whiplash-associated disorders (WAD) to healthy controls. WAD patients had reduced cervical range of motion (cROM) and impaired movement control. Central sensitization (CS) and dizziness were elevated in WAD, with CS linked to greater neck disability and dizziness but unrelated to functional measures. These results support early, targeted interventions to prevent chronic disability.

Introduction

WAD often result from traffic accidents, leading to persistent, complex symptoms [1]. Impaired cROM [2] and sensorimotor dysfunction [3] can contribute to prolonged disability. While CS has been linked to chronic WAD [4], its role in the subacute phase remains unclear. This study compared cROM and proprioception between individuals with subacute WAD and healthy controls and assessed associations between CS and both self-reported and functional outcomes, as well as between neck disability and dizziness and functional outcomes.

Methods

A cross-sectional study was conducted in a private physical therapy clinic in Iceland with 122 individuals with subacute WAD (mean age 40.5 years, SD 13.1) and 45 age-matched healthy controls (mean age 37.3 years, SD 11.6). Self-reported outcomes included the Neck Disability Index (NDI), Visual Analog Scale (VAS), Dizziness Handicap Inventory (DHI), and Central Sensitization Inventory (CSI). Functional measures (Whole Cervical ROM test, Head-Neck Relocation test for spatial awareness, and Butterfly test for movement control) were assessed using the NeckCare system. Data were analysed in Jamovi using mixed-model ANOVAs and general linear models.

Results and Discussion

Impaired cROM and movement control were observed in the WAD group compared to healthy controls (Table 1). Within the WAD group, CS and dizziness were markedly elevated (Table 2). CS showed no relationship with functional measures but was positively associated with neck disability (NDI, $p < .001$) and dizziness (DHI, $p = 0.008$), highlighting the role of CS in amplifying symptom severity. Neither dizziness nor neck disability significantly affected any functional measures, revealing a discrepancy between self-reported and objective impairments and underscoring the

importance of integrating both subjective and objective assessments when evaluating WAD.

Conclusions

Multimodal approaches, such as proprioceptive training, cognitive-behavioral therapy, sensorimotor training, and graded exposure, may help mitigate the effects of CS and reduce its contribution to prolonged disability. Early identification and treatment of high CS scores could be pivotal in preventing chronicity and promoting recovery.

Table 1: Means and standard deviations (SD) for functional measures. *statistically significant ($p < .005$)

		WADs	Controls
Butterfly	AA	5.0 (2.2)	2.9 (0.5)*
	TOT [%]	23.3 (12.5)	39.2 (9.8)*
	OS [%]	23.9 (9.2)	17.5 (5.7)*
	US [%]	52.8 (10.1)	43.3 (7.6)*
HNRT [°]	Flexion	2.8 (1.9)	2.7 (1.8)
	Extension	3.1 (2.0)	2.9 (1.9)
	Left rot	2.8 (2.0)	2.0 (1.3)
	Right rot	3.1 (1.9)	3.1 (1.6)
Cervical ROM [°]	Flexion	45.2 (13.7)	60.1 (8.9)*
	Extension	50.9 (16.8)	65.5 (11.9)*
	Left rot	58.0 (14.2)	73.4 (8.4)*
	Right rot	57.3 (14.7)	74.0 (7.3)*

Table 2: Means and standard deviations (SD) for self-reported measurements (scores ranging from 0-100).

	Mean (SD)	Equivalent to
NDI	42.3 (19.3)	Moderate disability
VAS	6.8 (2.1)	
CSI	49.7 (16.8)	Severe CS
DHI	35.2 (25.3)	Moderate disability

References

- [1] Spitzer et al. (1995). *Spine*, **20**(8):1S-73S.
- [2] Daenen et al. (2013). *J of Rehab Med*, **45**(2):113-22.
- [3] Ragnarsdóttir et al. (2024). *BMC Musculoskelet Disord*, **25**(1):346