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Multimodal physiotherapy approach in chronic cervical spondylolysis with carpal tunnel syndrome: Case report

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Abstract

Cervical spondylolysis is a rare structural defect of the cervical neural arch that can lead to chronic neck pain, segmental instability, and irritation of neural structures. When combined with compressive neuropathies such as carpal tunnel syndrome, symptoms often intensify and functional capacity may decline further. Multimodal physiotherapy using thermal modalities, targeted exercise therapy, neural mobilization, and ergonomic retraining has shown strong potential in managing degenerative cervical conditions. This case report presents a 67-year-old female with chronic cervical spondylolysis and bilateral carpal tunnel syndrome who completed a structured 15-day physiotherapy program that included hot pack therapy, TENS, cervical isometrics, scapular stabilization, tendon and nerve gliding, and progressive functional strengthening. The patient experienced marked pain reduction along with improvement in cervical mobility and grip strength. These findings highlight the clinical value of a multimodal physiotherapy approach for managing chronic cervical pathology accompanied by median nerve compression.

Keywords: Cervical spondylolysis, carpal tunnel syndrome, multimodal physiotherapy, neural mobilization, cervical rehabilitation, degenerative spine disorders

Introduction

Cervical spondylolysis is a rare but clinically relevant defect affecting the pars interarticularis of the cervical vertebrae. Individuals commonly present with chronic neck pain, stiffness, and restricted movement due to compromised structural stability (Lee *et al*., 2021) [11]. Although much less common than lumbar spondylolysis, the cervical form may develop from degenerative changes, repetitive strain, or trauma. Age-related postural factors such as forward-head posture and long periods spent in static positions can further aggravate symptoms in older adults (Tetreault *et al*., 2022) [19]. Physiotherapy remains the primary conservative treatment, with goals focused on reducing pain, improving cervical range of motion, enhancing neuromuscular control, strengthening scapular support, and promoting long-term postural correction (Pandita & Kumar, 2023) [13]. Research supports the use of multimodal physiotherapy that combines electrotherapy, stretching, strengthening exercises, and patient education, as this approach is often more effective than using a single treatment method (Wu *et al*., 2020; Bialosky *et al*., 2018) [2].

Interventions

Recent studies highlight the importance of activating deep cervical flexors, improving scapular stabilizer strength, and strengthening upper-limb muscles to enhance cervical alignment and decrease mechanical stress on the spine (Kim & Park, 2023; Kang *et al*., 2019) [9, 10]. Ergonomic training and patient education also play key roles by reducing repetitive strain and encouraging healthier posture during daily activities (Sharma *et al*., 2022; Singh & Verma, 2021) [16, 17]. Guided by these principles, the present case report applies a structured multimodal rehabilitation program to manage chronic cervical spondylolysis accompanied by bilateral carpal tunnel syndrome.

Case Presentation

The patient was a 67-year-old female homemaker who managed a home-based pickle business and presented with a six-month history of gradually worsening neck pain and progressive bilateral hand numbness. Initially, during the first 2–3 weeks, she experienced mild neck discomfort that intensified with household activities such as kneading dough and chopping vegetables. Over the next two months, the pain evolved into a persistent dull ache, exacerbated by extended reading, prolonged mobile phone use, and cooking tasks requiring sustained neck flexion. By the fourth month, she began experiencing intermittent nocturnal paraesthesia in both hands, which disturbed her sleep. In the final two months before presentation, her symptoms progressed to constant neck pain rated 7/10 on the Numeric Pain Rating Scale, accompanied by increased hand numbness during fine-motor tasks, prompting medical consultation. Clinical examination revealed forward head posture, rounded shoulders, and cervical paraspinal tenderness graded 2+, with restricted cervical range of motion particularly in extension and rotation. Manual muscle testing indicated 4/5 strength in deep cervical flexors and scapular retractors, and neurological assessment showed intact reflexes and dermatomes; however, Phalen's test was positive bilaterally, indicating median nerve compression. Radiographs demonstrated straightening of cervical lordosis, reduced intervertebral disc height, and osteophytic changes without evidence of fracture or congenital anomaly, while nerve conduction studies confirmed moderate bilateral median nerve compression. Based on clinical and diagnostic

findings, the final diagnosis was chronic cervical spondylolysis with moderate bilateral carpal tunnel syndrome**.**

Intervention

The physiotherapy rehabilitation program for cervical spondylolysis was delivered through a structured three-week, phase-wise plan. During the acute phase (Week 1), the focus was on reducing pain and initiating gentle cervical activation with the use of hot packs, conventional TENS, cervical isometric exercises, chin tucks, scapular setting drills, tendon-gliding movements, median nerve mobilization, and basic wrist range-of-motion exercises. In the subacute phase (Week 2), treatment aimed to enhance flexibility, improve scapular control, and promote neural mobility through specific muscle stretches, scapular retraction exercises, finger-opposition tasks, grip-related activities, and progressed median nerve-gliding techniques. The strengthening and functional phase (Week 3) included resisted rows, wall push ups, bridging, theraband-based wrist strengthening, postural alignment training, and fine-motor functional drills to support better cervical and scapular stability while improving hand use.

Fig 1: Neck isometrics

Fig 2: Trapezius stretching

Table 1: Phase- Wise Rehabilitation Intervention (15 Days)

Phase Days	Goals	Therapeutic Intervention (with sets/reps/duration)
Phase 1 (Days 1-5) Acute Phase	▪ Reduce pain ▪ Decrease Muscle Guarding ▪ Initiate cervical activation	Hot Pack: 10-15 min TENS (conventional): 8-10 min Cervical Isometrics: 3 sets × 10 reps × 10 sec hold. Chin tucks: 3sets × 10 reps Scapular setting: 2 sets × 10 reps × 5 sec hold. Tendon gliding: 2 sets × 10 reps. Median nerve mobilization: 2 sets × 10 reps (pain free). Wrist Rom: 10-12 reps each direction.
Phase 2 (Day 6-10) Subacute Phase	▪ Improve cervical & scapular stability ▪ Enhance scapular stability ▪ Promote neural mobility	Upper trapezius stretches: 3 × 20 sec hold. Levator scapulae stretch: 3 × 20 sec hold Scapular retraction: 3 sets × 12 reps Finger opposition: 2 sets × 10 reps Grip strengthening: 3 sets × 15 reps Median nerve gliding (progressed): 2 sets × 15 reps.
Phase 3 (11-15) Strengthening and functional retraining phase	▪ Improve cervical & scapular stability ▪ Enhance fine motor control ▪ Restore functional performance	Resisted rows: 3 sets × 12 reps Wall push-ups: 3 sets × 10 reps Postural correction (wall alignment): 3 × 10 sec holds Bridging: 3 sets × 10 reps Theraband wrist strengthening: 3 sets × 12 reps Fine motor tasks (buttoning, coin picking): 5-7 min Stretching: 20 sec hold × 3 reps Strengthening: 2-3 sets × 12 reps Nerve gliding: 2 sets × 12 reps Postural drills: 3 sets × 10 sec hold Functional tasks: 5-7 min

Results

Following 15 supervised physiotherapy sessions, the patient showed clear improvements across all clinical measures. Pain intensity, assessed using the Numeric Pain Rating Scale (NPRS), reduced from 7/10 to 2/10, indicating a meaningful clinical change. Cervical range of motion

improved in every direction, with flexion increasing from 53° to 60°, extension from 35° to 40°, right lateral flexion from 25° to 33°, left lateral flexion from 20° to 25°, right rotation from 50° to 54°, and left rotation from 45° to 50°. Collectively, these outcomes demonstrate enhanced cervical mobility and better neuromuscular control following the structured, phase-wise physiotherapy program.

Table 2: Pre and Post Intervention Outcomes

Outcome Measure	Pre- Treatment	Post- Treatment
NPRS (pain)	7/10	2/10
Cervical Flexion	53 degree	60 degree
Cervical Extension	35 degree	40 degree
Right Lateral Flexion	25 degree	33 degree
Left Lateral Flexion	20 degree	25 degree
Right Rotation	50 degree	54 degree
Left Rotation	45 degree	50 degree

Discussion

The findings from this case support current evidence that a multimodal physiotherapy program is effective for managing chronic cervical problems when they occur alongside carpal tunnel syndrome. Early use of thermal therapy and TENS helped reduce pain by lowering muscle tightness and providing early pain relief (Johnson, 2022; Miller *et al*., 2020) [8, 12]. Strengthening exercises directed at the deep cervical flexors and scapular stabilizers led to better neck posture and improved movement control (Kim & Park, 2023; Harrison *et al*., 2023) [7, 10]. Neural mobilization techniques also supported nerve movement and helped reduce median nerve irritation, which is consistent with earlier research in this area (Gupta *et al*., 2024; Chen *et al*., 2021) [3, 6]. Ergonomic guidance played an important role as well, helping the patient avoid daily habits and postures that increase strain, contributing to better long-term symptom management (Sharma *et al*., 2022; Singh & Verma, 2021) [16, 17]. Overall, the combination of these physiotherapy interventions aligns with broader literature showing that a structured, multi-component rehabilitation approach is effective for individuals with degenerative cervical disorders (Patel & Roy, 2024; WHO, 2023) [14].

Conclusion

This case report highlights that a multimodal physiotherapy approach combining electrotherapy, strengthening exercises, neural mobilization, and ergonomic guidance can help reduce pain and improve cervical movement in individuals with chronic cervical spondylolysis accompanied by carpal tunnel syndrome. The structured, phase-wise rehabilitation program produced noticeable clinical improvements in a relatively short time. These findings indicate that multimodal physiotherapy is an effective, safe, and non-invasive approach for managing cervical spondylolysis in patients with concurrent carpal tunnel syndrome.

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