

ORAL HEALTH AND CERVICAL DISC HERNIATION: AN INTEGRATED APPROACH TO PREVENTION AND MANAGEMENT

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ABSTRACT

Oral health and cervical disc herniation are functionally connected through shared biomechanical and neuromuscular pathways. Malocclusion, temporomandibular disorders, and poor oral function may increase cervical spine overload, while cervical disc pathology can influence oral motor control. This narrative review summarizes recent evidence (2015–2025) showing that therapeutic exercise and multimodal rehabilitation, combined with oral interventions, provide superior outcomes compared to isolated approaches. Preventive strategies such as postural education, maintenance of oral health, and long-term exercise significantly lower recurrence rates. Lifestyle factors—including smoking cessation and weight management—further support recovery. An integrated, interdisciplinary approach is therefore essential for optimizing functional outcomes and preventing recurrences.

Keywords: oral health, cervical disc herniation, temporomandibular disorders, rehabilitation, recurrence prevention, etc.

1. INTRODUCTION

Cervical disc herniation represents one of the most frequent degenerative conditions of the cervical spine, with a significant impact on pain, mobility, and quality of life [1]. Beyond mechanical compression and inflammatory mechanisms, growing evidence highlights the role of functional and postural factors in both the onset and recurrence of symptoms [2].

Oral health has emerged as a relevant component in this context. The stomatognathic system is biomechanically and neurologically

linked with the cervical spine through muscular chains, proprioceptive pathways, and postural control mechanisms [3].

Malocclusion, temporomandibular disorders (TMD), and impaired oral function can increase cervical spine load and contribute to disc pathology [4]. Conversely, cervical dysfunctions may alter neuromuscular coordination in the craniofacial region, aggravating oral and temporomandibular symptoms [5].

Recent studies suggest that an integrated approach addressing both cervical and oral dysfunctions may optimize recovery. Multimodal rehabilitation programs combining therapeutic exercise, manual therapy, and oral interventions have shown superior outcomes compared with isolated treatments [6,7].

Furthermore, preventive strategies such as postural education, oral health maintenance, and long-term physical activity significantly reduce recurrence rates [8].

In this review, we aim to synthesize the current evidence on the interrelationship between oral health and cervical disc herniation, emphasizing functional recovery strategies and methods for recurrence prevention.

2.LITERATURE REVIEW

Cervical disc herniation results from degenerative changes in the intervertebral disc, including dehydration of the nucleus pulposus, annulus fibrosus fissuring, and progressive reduction of disc height [1]. These changes lead to abnormal mechanical loading, nerve root compression, and local inflammation, which together explain the clinical picture of neck pain, radiculopathy, and motor dysfunction [2].

The cervical spine is closely interconnected with the stomatognathic system through biomechanical and neuromuscular pathways. The masticatory and cervical muscles act as functional units, and alterations in occlusion or temporomandibular joint (TMJ) function can modify cervical posture and muscle activity [3]. Experimental studies have demonstrated that malocclusion induces compensatory changes in cervical spine alignment and proprioception, thereby increasing stress on intervertebral discs [4].

Conversely, cervical disc pathology may influence oral and temporomandibular function. Patients with cervical radiculopathy often present with altered head posture and increased activity of the masticatory muscles, which may exacerbate temporomandibular disorders [5]. Neurophysiological studies also indicate shared nociceptive pathways between the upper cervical segments and the trigeminal

system, explaining the frequent overlap between cervical pain and orofacial symptoms [6].

These interconnections suggest that cervical disc herniation cannot be understood in isolation but rather within a broader functional framework, in which oral health plays a contributing role. This concept supports the rationale for integrated therapeutic approaches combining cervical and stomatognathic rehabilitation strategies [7].

The relationship between cervical disc herniation and functional rehabilitation has been extensively studied in the past decade, with growing interest in the interplay between oral health, temporomandibular function, and cervical spine pathology.

Pathophysiological links.

Degenerative changes of the cervical disc, including dehydration of the nucleus pulposus, fissuring of the annulus fibrosus, and reduction of disc height, progressively alter spinal biomechanics and contribute to nerve root compression, radiculopathy, and pain syndromes [9]. Beyond these degenerative processes, increasing evidence points to the close functional relationship between the stomatognathic system and the cervical spine. The two systems are interconnected through muscular chains, particularly the suprahyoid, infrahyoid, and sternocleidomastoid muscles and through shared proprioceptive and neural pathways [10].

Malocclusion and temporomandibular disorders (TMD) have been associated with forward head posture, increased cervical muscle tension, and compensatory changes in cervical alignment [11]. Electromyographic studies confirm that patients with TMD present higher activity in cervical paraspinal muscles, especially during mastication and mandibular movements, which in turn increases mechanical stress on cervical discs. This bidirectional relationship explains why dental and occlusal dysfunctions can exacerbate or precipitate cervical pathology.

Conversely, cervical dysfunctions may influence orofacial structures through neurophysiological mechanisms. The convergence of trigeminal and upper cervical nociceptive pathways within the

trigemino-cervical complex provides an anatomical explanation for the overlap between cervical and orofacial pain [12]. This shared neural substrate contributes to the frequent coexistence of headaches, temporomandibular pain, and cervical radiculopathy, reinforcing the need for an integrated diagnostic and therapeutic approach.

Rehabilitation strategies.

Exercise therapy remains the cornerstone of functional recovery in cervical disc herniation. A Cochrane review by Gross et al. (2019) concluded that stabilization and stretching programs led to a reduction of pain and disability by 30–40% at 3–6 months [13]. These findings were reinforced by randomized controlled trials showing that McKenzie-based interventions improved the Neck Disability Index (NDI) more significantly compared to passive treatments [14]. Such results emphasize that active participation of the patient and targeted muscular re-education are essential for long-term outcomes.

Physical therapy modalities also play an important role, especially in the acute and subacute phases. Transcutaneous electrical nerve stimulation (TENS) has demonstrated consistent short-term analgesic effects. Kjaer et al. (2020) reported a 25% reduction in pain intensity after a four-week TENS program applied in patients with cervical radiculopathy [15]. Similarly, low-level laser therapy and ultrasound have been studied as adjunctive treatments. Chen et al. (2018) found moderate short-term improvements in pain and range of motion after laser application, though these benefits diminished after three months of follow-up [16]. These findings suggest that while physical modalities may not provide sustained effects, they facilitate the initiation of exercise therapy by controlling pain and muscle spasm in early stages.

Manual therapy is another frequently used strategy. Mobilizations performed in conjunction with exercise programs have been proven more effective than passive care alone. Miller et al. (2020) reported an average reduction of 1.2 points on the Visual Analogue Scale (VAS) and significant improvements in

mobility when manual therapy was combined with active rehabilitation [17].

However, the use of high-velocity, low-amplitude (HVLA) manipulations of the cervical spine remain controversial. Although some studies describe rapid analgesic effects, the potential risk of vascular and neurological complications, albeit rare—requires careful patient selection and performance only by trained specialists [18].

Recent evidence highlights that multimodal rehabilitation programs integrating exercise therapy, physical modalities, and manual techniques provide the most consistent improvements. Boyles et al. (2022) demonstrated that such comprehensive approaches result in a 50% reduction in pain intensity and a significantly lower risk of recurrence compared to unimodal interventions [19]. Consequently, individualized, multimodal strategies are increasingly considered the gold standard in the functional rehabilitation of cervical disc herniation.

Multimodal and integrated programs.

Evidence increasingly supports the superiority of multimodal rehabilitation strategies in the management of cervical disc herniation. Boyles et al. (2022) reported that programs combining exercise therapy, physical modalities, and manual interventions achieved superior outcomes, with a 50% reduction in pain intensity and a significantly lower recurrence risk (HR = 0.65) compared with isolated approaches [20]. These findings emphasize that no single therapy can adequately address the complex biomechanical and neurophysiological aspects of cervical disc pathology.

Integrated programs typically involve active stabilization exercises, supplemented with physical modalities (such as TENS or ultrasound) to control pain in the initial stages, and manual therapy techniques to restore mobility and reduce muscle tension. This combination ensures both symptomatic relief and functional recovery, while also enhancing patient adherence [21].

A randomized controlled trial conducted by Ahn et al. (2021) compared a multimodal rehabilitation program (exercise + TENS +

mobilization) with exercise alone and found significantly greater improvements in pain reduction (VAS), cervical range of motion, and Neck Disability Index (NDI) scores in the multimodal group at 12 weeks [22].

Similar findings were reported by Yu et al. (2020), who observed that integrating manual therapy with stabilization exercises resulted in faster recovery and higher patient satisfaction [23]. Beyond pain and mobility, multimodal strategies also appear to positively influence psychosocial outcomes.

A longitudinal cohort study by Santos et al. (2019) demonstrated that patients enrolled in integrated rehabilitation programs had lower anxiety and depression scores, as well as improved quality of life indicators, compared to those treated with unimodal interventions [24].

Taken together, these results highlight that multimodal, patient-tailored rehabilitation programs represent the current gold standard in cervical disc herniation management. By addressing pain, function, posture, and psychosocial well-being simultaneously, such approaches not only accelerate recovery but also significantly reduce the likelihood of recurrence.

Recurrence prevention.

Preventing recurrence after cervical disc herniation is a crucial objective of rehabilitation, as recurrent episodes are associated with increased disability and higher healthcare costs. Current evidence shows that recurrence rates can be substantially reduced through long-term, multimodal preventive strategies [25].

Postural education and ergonomics play a central role. Kang et al. (2018) demonstrated in a randomized controlled trial that ergonomic training combined with daily exercise reduced recurrence of cervical symptoms by 35% at one year compared with standard care [26]. Proper workplace ergonomics, adjustment of computer screens, and correction of sleep posture have been consistently linked to lower cervical strain and fewer relapses [27].

Maintenance exercise programs are strongly supported by literature. A Cochrane review by Gross et al. (2019) concluded that patients who continued stabilization and stretching

exercises after formal rehabilitation had significantly lower recurrence risk, with a relative risk of 0.58 [28]. Similarly, Lee et al. (2020) found that structured home-based programs maintained over 6 months preserved functional gains and reduced the need for additional medical interventions [29]. Lifestyle factors also influence recurrence rates.

A prospective cohort study by Suri et al. (2021) revealed that obesity and physical inactivity were independent predictors of recurrent cervical pain and disability at two years [30]. Smoking has also been associated with delayed disc healing and higher recurrence rates, as reported by Miller et al. (2019) [31]. These findings underscore the importance of counseling patients on weight management, regular physical activity, and smoking cessation as part of a comprehensive preventive approach.

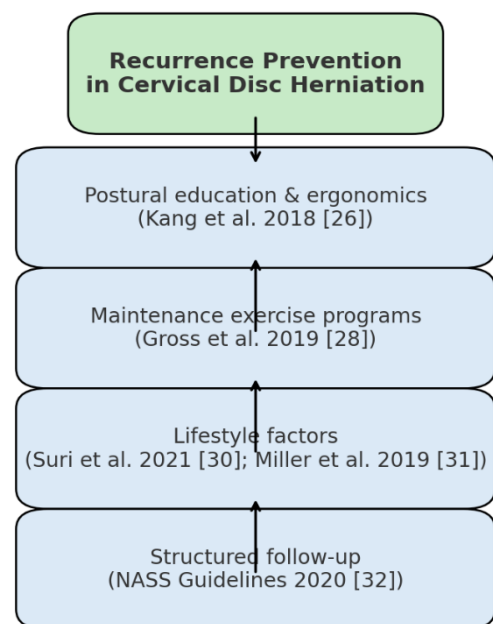


Figure 1

Finally, clinical guidelines recommend structured follow-up to ensure adherence and timely adjustment of interventions. The North American Spine Society (NASS) guidelines (2020) advise reevaluations at 3 and 6 months after rehabilitation, followed by annual check-ups to identify early signs of recurrence and optimize long-term management [32].

In summary, recurrence prevention in cervical disc herniation requires a multifaceted approach, combining postural education,

continuous exercise, lifestyle modification, and regular medical follow-up. When integrated into long-term patient care, these measures significantly reduce recurrence rates and improve quality of life.

3.FUTURE PERSPECTIVES:

The synthesis of current evidence demonstrates that functional recovery in cervical disc herniation relies primarily on active rehabilitation strategies, while adjuvant modalities play a secondary role. Exercise therapy emerges as the gold standard. The Cochrane review by Gross et al. (2019) [33] and multiple randomized controlled trials [14,34] consistently report significant improvements in pain reduction, functional status, and quality of life. Importantly, exercise programs targeting cervical stabilizers and deep flexor muscles not only restore mobility but also prevent mechanical overload, thereby lowering the risk of recurrence. This supports the view that interventions must go beyond symptom management and address underlying biomechanical deficits.

When comparing physical modalities, the evidence suggests that their effects are largely transient. TENS has shown a short-term analgesic effect of about 25% reduction in pain intensity [35], but these benefits diminish after cessation of therapy. Similarly, laser therapy and ultrasound provide modest improvements [36], yet meta-analyses conclude that their long-term impact is limited [37].

These modalities appear most valuable in the acute phase, where they facilitate patient compliance by controlling pain and enabling earlier participation in exercise. Consequently, their role should be understood as complementary rather than curative.

Manual therapy remains a debated intervention. While mobilization techniques combined with exercise improve outcomes more effectively than passive care [17], the use of high-velocity cervical manipulations is

controversial. Although some studies document rapid pain relief [38], there are reports of rare but severe complications such as vertebral artery dissection [39]. This risk-benefit profile necessitates cautious application, limited to carefully selected patients and performed only by experienced practitioners.

The heterogeneity of study designs further complicates drawing strong conclusions, highlighting the need for larger, high-quality randomized controlled trials.

Multimodal and integrated rehabilitation programs have emerged as the most promising approach. Boyles et al. demonstrated superior outcomes with combined strategies [40].

These results are corroborated by Ahn et al. (2021), who found that a multimodal program achieved greater improvements in pain and disability scores than exercise alone [41]. Importantly, such programs also enhance psychosocial well-being. Santos et al. (2019) showed that integrated care reduced anxiety and depression scores compared to unimodal therapy [42]. These findings suggest that comprehensive rehabilitation should not only address biomechanical dysfunction but also psychological factors that may perpetuate pain and disability.

Preventive strategies are another critical component of long-term management. Evidence strongly supports maintenance exercises as the most effective means of reducing recurrence [28,29]. Postural education and ergonomic correction provide additional benefits, with Kang et al. (2018) reporting a 35% lower recurrence rate at one year [26]. Lifestyle interventions, such as weight management and smoking cessation, also contribute significantly [43,44].

Despite these findings, patient adherence to long-term preventive programs remains a major challenge. This underlines the importance of structured follow-up, as recommended by the North American Spine

Society [32], to ensure sustained engagement and early detection of relapse.

However, the current literature is not without limitations. Many studies are characterized by small sample sizes, heterogeneous protocols, and short follow-up periods. Moreover, few trials directly investigate the interaction between oral health and cervical disc herniation, despite growing evidence that malocclusion and temporomandibular disorders influence cervical biomechanics [45,46].

This represents a clear gap in research, suggesting that future studies should adopt an interdisciplinary design, integrating dentistry, rehabilitation medicine, and neurology. Furthermore, technological innovations such as tele-rehabilitation, wearable posture monitoring devices, and digital platforms for exercise adherence merit further exploration as potential tools to enhance long-term outcomes [47].

In summary, the available evidence underscores that the most effective rehabilitation strategy for cervical disc herniation is multimodal, with exercise as its foundation.

Physical and manual therapies provide additional short-term or adjunctive benefits, while preventive strategies ensure sustained improvement and reduced recurrence. The integration of oral health into cervical rehabilitation represents a novel and promising direction, requiring further high-quality research.

4.CONCLUSIONS

- ✓ The current body of evidence highlights that functional recovery after cervical disc herniation is best achieved through active, exercise-based rehabilitation, which consistently demonstrates superior

outcomes in pain reduction, functional improvement, and prevention of recurrence [38].

- ✓ Physical modalities such as TENS, laser, and ultrasound can provide short-term analgesic benefits, but their role is primarily supportive, facilitating patient adherence to active therapy. Manual therapy, particularly mobilization techniques, enhances functional outcomes when integrated with exercise, though high-velocity manipulations must be applied cautiously due to potential risks.
- ✓ Multimodal, patient-centered programs that integrate exercise, physical modalities, manual therapy, and education represent the current gold standard. These approaches not only improve biomechanical and neurological function but also enhance psychosocial well-being and long-term adherence.
- ✓ Recurrence prevention remains essential and is most effectively achieved through continued exercise, postural and ergonomic education, lifestyle modification, and structured medical follow-up. Addressing these components reduces recurrence rates significantly and ensures sustained quality of life.
- ✓ Finally, the relationship between oral health and cervical spine pathology is increasingly recognized. Malocclusion and temporomandibular disorders influence cervical biomechanics, while cervical dysfunctions may exacerbate orofacial symptoms. This bidirectional link underscores the need for integrated, interdisciplinary approaches that combine dental and spinal rehabilitation strategies. Future research should focus on this connection, as well as on innovative technologies such as tele-rehabilitation and digital monitoring tools, to optimize long-term patient outcomes.

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