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Acute effects of rigid shoulder taping in patients with cervical disc herniation

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ABSTRACT

Aims: This study aimed to investigate the acute effects of non-elastic taping applied to the shoulder on the painful side in individuals with cervical disc herniation, focusing on pain and range of motion (ROM).

Methods: Forty participants were randomly assigned to two groups; study group (n=20) and control group (n=20). Both groups received a conventional physiotherapy program including TENS, vacuum interferential current, hot pack, and ultrasound. The control group received no additional intervention. The study group received one session of non-elastic taping applied to the painful side shoulder in addition to conventional physiotherapy. Pain was assessed using the Visual Analog Scale (VAS), and cervical ROM was measured with a universal goniometer before and after the intervention.

Results: Within-group comparisons revealed statistically significant improvements in pain and ROM in both groups ($p<0.01$). Although pain reduction was observed in both groups, no statistically significant difference was found between them ($p>0.05$). Similarly, no significant differences were observed between groups in any cervical ROM measurements before and after the intervention ($p>0.05$).

Conclusion: The findings showed that pain was reduced and ROM was increased in both groups, but there was no significant difference between them. Further studies with larger sample sizes and long-term follow-ups are recommended to evaluate the effects of non-elastic taping.

Keywords: Pain, taping, range of motion, cervical disc herniation

INTRODUCTION

Intervertebral discs are cartilaginous structures located between adjacent vertebrae that function as shock absorbers, supporting the spine against axial loading.[1] Anatomically, they consist of three components: the centrally located nucleus pulposus, the outer annulus fibrosus, and the endplates that anchor the disc to the adjacent vertebral bodies.[2] Disc herniation is a pathological condition characterized by the partial or complete protrusion of the nucleus pulposus through the annulus fibrosus. This condition may manifest either acutely often due to trauma or chronically, typically resulting from degenerative changes such as reduced proteoglycan content and loss of hydration, leading to weakening of the nucleus pulposus. Acute herniations tend to produce more severe and sudden symptoms compared to chronic cases, due to extrusion of the nucleus through a defect in the annular ring. Cervical disc herniation can result in significant functional impairments. It most frequently occurs at the C5-C6 and C6-C7 intervertebral levels, thereby producing symptoms corresponding to the C6 and C7 nerve roots, respectively. Patients with cervical disc herniation often experience neck pain, reduced cervical range of motion (ROM), and functional limitations.[2]

The most common subjective complaints include ipsilateral arm pain or paresthesia along the corresponding dermatome. A comprehensive neurological examination is required to assess sensory deficits, motor weakness, and abnormalities in deep tendon reflexes.[3] Although surgical interventions are available, numerous conservative treatment options are commonly employed.[4] Conservative treatment remains the first-line approach, with non-surgical methods such as oral neuropathic pain medications, physical therapy, and epidural steroid injections forming the basis of symptom management. In addition, clinicians often incorporate taping techniques to manage pain and edema and to provide functional support.[5] Taping is a widely utilized method in clinical settings for both injury prevention and rehabilitation.[6] It restricts unwanted joint movements while allowing or facilitating desired ones. Another proposed mechanism is the enhancement of proprioceptive feedback through increased sensory input.[7] Two primary types of tape are used in clinical practice for

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biomechanical support: rigid (non-elastic) adhesive tape[6] and elastic therapeutic tape.[8] Rigid tape provides superior support and joint positioning compared to elastic tape, as it aims to maintain the joint in a defined position while still allowing functional movement.[5]

Therapeutic taping has demonstrated short-term clinical efficacy in managing certain musculoskeletal disorders, including pain reduction,[9,10] improvement in ROM,[11] and gait enhancement.[12] However, the exact mechanisms underlying its therapeutic effects are still not fully understood.[10,12] Neuroplastic changes have been observed in individuals with musculoskeletal pathologies,[13] though the extent to which such changes influence regional kinematics and neuromuscular control remains unclear. These mechanisms are thought to involve neuromuscular or non-cortical neurological pathways rather than alterations in corticospinal excitability.[11]

The aim of this study was to investigate the acute effects of non-elastic taping applied to the painful-side shoulder in individuals with cervical disc herniation, focusing on its impact on pain intensity and cervical ROM. We hypothesized that maintaining the shoulder in a passively elevated position with rigid tape would reduce neural tension caused by the disc pathology, thereby alleviating pain and improving range of motion.

METHODS

Ethical Considerations

The study was approved by the Üsküdar University Non-interventional Researches Ethics Committee (Date: 23.02.2023, Decision No: 61351342/2023-51) and conducted in the Physical Therapy and Rehabilitation Department of Kadıköy Medicana Hospital between March and August 2023. The study adhered to the principles of the Declaration of Helsinki.

Informed Consent

This study was conducted in accordance with ethical principles, and written and verbal informed consent was obtained from all participants prior to their inclusion. Participants were informed about the study's purpose, procedures, potential risks, and benefits. They were assured that participation was voluntary and that they could withdraw at any time.

Study Design

This study was designed as a prospective, randomized controlled trial.

Participants

The study included 40 volunteers who met the inclusion criteria. Participants were required to be between the ages of 18 and 60 and have a confirmed diagnosis of cervical disc herniation. Individuals with coexisting cervical pathologies, cognitive or visual impairments, or skin hypersensitivity were excluded from the study.

Prior to randomization, all participants received baseline assessments. A blinded independent researcher randomly allocated participants into either the study or control group using a computer-generated simple randomization list.

Data Collection Tools and Procedures

Intervention program: Both groups received a conventional physiotherapy program consisting of transcutaneous electrical nerve stimulation (TENS, 20 min), vacuum interferential current therapy (20 min), hot pack application (20 min), and therapeutic ultrasound (5 min). No additional intervention was administered to the control group.

The study group received one additional session of non-elastic taping applied to the shoulder on the painful side following the physiotherapy session. The tape was kept in place for 30 minutes while participants remained seated without performing any physical activity. Post-intervention measurements were taken immediately after the tape was removed.

Pain levels were evaluated using the Visual Analog Scale (VAS), and cervical ROM was assessed using a universal goniometer, both before and after the intervention.

Taping procedure: Taping was performed in a seated position after the completion of physiotherapy. Two types of tape were used; Rollfix (hypoallergenic, applied underneath) and Rollipek (rigid, applied on top). The tape was initially applied over the middle deltoid muscle, and while passively elevating the patient's arm, it was extended and fixed over the cervicothoracic junction region while maintaining tension (Figure). VAS and goniometric assessments were repeated after the taping. No allergic reactions were observed in any participants during the procedure.

Figure. Application of non-elastic taping to the shoulder region

Socio-Demographic and Clinical Information Form: This form collected socio-demographic and clinical data from all participants, including age, height, weight, body-mass index (BMI), educational level, alcohol and tobacco use, duration of complaints, side of pain, and medical history. Comorbidities were also evaluated to ensure eligibility.

Visual Analog Scale (VAS): Pain intensity before and after the intervention was assessed using the Visual Analog Scale. The VAS consists of a horizontal line anchored by two verbal descriptors at each end, where participants mark a point that best represents their current level of perceived pain.[14]

Range of motion (ROM) measurement: Cervical ROM measurements were taken before and after the intervention using a universal goniometer. ROM assessment is a widely used musculoskeletal evaluation method employed by physiotherapists to objectively assess joint function, asymmetry, and treatment effectiveness.[15] Due to its ease of use, low cost, and established reliability and validity in numerous studies, the universal goniometer remains a preferred tool in clinical settings for ROM evaluation.[16]

Statistical Analysis

All data analyses were performed using SPSS version 25.0 for Windows (SPSS Inc., IBM Corp., Armonk, NY). Descriptive statistics were calculated using means and standard deviations (SD) for continuous variables, and frequency analyses were used for nominal and binary data. The normality of the data distribution was assessed with the one-sample Kolmogorov-Smirnov test and histogram inspection. The Wilcoxon signed-rank test was used for within-group comparisons before and after taping. Independent samples T tests were used for between-group comparisons. Statistical significance was set at $p<0.05$.

RESULTS

The socio-demographic characteristics of the participants are presented in Table 1. There were no statistically significant differences between the study and control groups in terms of age, height, or weight ($p>0.05$).

Table 1. Socio-demographic characteristics of the participants

		Study group (n=20)	Control group (n=20)	
		n (%)	n (%)	
Sex	Female	13 (65)	10 (50)	
	Male	7 (35)	10 (50)	
Education level	High school	4 (20)	3 (15)	
	University	16 (80)	17 (85)	
Alcohol use	Yes	8 (40)	7 (35)	
	No	12 (60)	13 (65)	
Smoking	Yes	13 (65)	13 (65)	
	No	7 (35)	7 (35)	
Painful side	Right	12 (60)	13 (65)	
	Left	8 (40)	7 (35)	
Complaint duration	1 week	2 (10)	4 (20)	
	2 weeks	8 (40)	3 (15)	
	3 weeks	5 (25)	7 (35)	
	4 weeks	5 (25)	6 (30)	
		Mean±SD	Mean±SD	p
Age (years)		37.75±8.45	39.35±11.13	0.081
Height (cm)		148.15±57.22	133.40±69.27	0.128
Weight (kg)		71.35±11.32	72.20±12.46	0.694

SD: Standard deviation

In group and inter-group comparisons for pain severity and cervical ROM are presented in Table 2. A statistically significant improvement was observed in pain and ROM within both groups following treatment ($p<0.01$). While both groups experienced a reduction in pain severity, no statistically significant difference was found between the groups ($p>0.05$). Similarly, no statistically significant inter-group differences were observed in any of the cervical ROM measurements before and after treatment ($p>0.05$).

Table 2. Within-group and between-group comparisons of pain and ROM

Variable		Study group (n=20)		Control group (n=15)		
		Mean±SD	p	Mean±SD	p	p
VAS	Pre-treatment	5.35±2.10	<0.01	5.15±2.53	<0.01	0.783
	Post-treatment	2.35±1.56		3.30±2.05		0.118
Flexion (°)	Pre-treatment	38.60±7.40	<0.01	39.70±7.48	<0.01	0.606
	Post-treatment	43.25±5.89		43.65±5.10		0.989
Extension (°)	Pre-treatment	37.35±7.76	<0.01	38.20±6.44	<0.01	0.786
	Post-treatment	41.65±6.86		41.45±5.23		0.644
Lateral flexion (right) (°)	Pre-treatment	35.10±5.49	<0.01	34.35±5.73	<0.01	0.663
	Post-treatment	39.05±6.21		36.70±4.13		0.186
Lateral flexion (left) (°)	Pre-treatment	35.40±5.73	<0.01	34.20±6.24	<0.01	0.549
	Post-treatment	39.25±3.62		38.20±5.43		0.565
Rotation (right) (°)	Pre-treatment	71.65±8.52	<0.01	72.30±9.13	<0.01	0.806
	Post-treatment	75.60±7.52		75.80±7.00		0.946
Rotation (left) (°)	Pre-treatment	71.30±9.35	<0.01	73.05±8.30	<0.01	0.567
	Post-treatment	75.85±7.46		76.85±7.11		0.595

ROM: Range of motion, VAS: Visual Analog Scale, SD: Standard deviation

DISCUSSION

This study aimed to evaluate the acute effects of non-elastic taping applied to the shoulder on the painful side in individuals with cervical disc herniation, specifically regarding pain intensity and cervical ROM. The results demonstrated a significant reduction in pain and improvement in ROM within both the intervention and control groups; however, no statistically significant differences were found between the two groups.

Neck pain is recognized as a major global public health concern,[17,18] with the cervical intervertebral disc considered a common source of neck pain,[19,20] In cases of cervical disc herniation-with or without radiculopathy-conservative treatment is typically the first-line approach. Various non-surgical treatment modalities are available, supported by varying levels of scientific evidence. These include oral medications, injections, physiotherapy, cervical collars, manual therapy, and acupuncture. Despite the lack of strong consensus regarding specific exercise combinations, physiotherapy remains a primary treatment method for patients presenting with neck pain and/or radicular symptoms not requiring surgical intervention.[21] For this reason, pain was selected as the primary outcome in the current study.

Among conservative treatment options, taping is a therapeutic method commonly used by physiotherapists for the prevention and management of musculoskeletal conditions, including spinal pain.[22,23] Although taping techniques are widely used in clinical practice, their efficacy remains under investigation due to inconsistent evidence.[24] One study examined the effects of both elastic and non-elastic taping on spinal pain and disability, aiming to determine their effectiveness relative to other interventions. Elastic taping was shown to have low-level evidence when compared to placebo and moderate-level evidence compared to no treatment in patients with neck pain. In contrast, non-elastic taping demonstrated only a small effect on pain and was supported by low-level evidence when compared to no treatment.[24]

In a study investigating kinesio taping in patients with cervical radiculopathy, the addition of kinesio taping to conventional treatment was associated with reduced neck pain, decreased disability, and improved upper extremity function.[25] Another study involving patients with non-specific neck pain showed that kinesio taping led to significant improvements in pain and disability; however, no statistically significant differences were observed in cervical ROM when compared to an exercise-only group.[26] Current literature suggests that kinesio taping is primarily used to alleviate pain, reduce swelling and disability, and improve circulation. Non-elastic taping, on the other hand, stands out due to its supportive and positional correction properties. McConnell, for example, utilized non-elastic taping to support the patella and maintain it in the proper position in patients with patellofemoral pain syndrome.[27] This method has also been applied to the shoulder and hip joints.[5] One study reported an acute increase in shoulder flexion and abduction ROM following McConnell taping,[11] although the effect was not sustained at 24-hour follow-up, suggesting a primarily mechanical effect. In contrast, our study may have provided not only mechanical support but also a reduction in neural tension at the nerve root, thus offering a neurophysiological benefit as well. In a study investigating patients with shoulder pain and limited ROM, mobilization techniques with and without taping were compared. Both groups demonstrated significant acute improvements; however, improvements were more persistent in the taping group during a one-week follow-up.[28] Similarly, in a study involving stroke patients, modified Mulligan techniques with and without taping were compared, showing significant improvements in both active and passive ROM in both groups.[29]

The limited number of studies focusing specifically on non-elastic taping is noteworthy. This study may contribute to the literature by addressing this gap. Non-elastic taping is one of the earliest taping methods and is still used as an adjunct in the management of musculoskeletal injuries. Its mechanism of action is thought to involve increased proprioception and mechanical support for joint protection.[24] Given the rationale for using non-elastic taping by McConnell and Mulligan, this method could be explored in greater detail as a potential intervention for cervical disc herniation. Patients with cervical disc herniation are often evaluated using inhibition tests, one of which is the shoulder abduction test. This test reduces tension on the nerve root and can alleviate pain, particularly in cases involving lower cervical radiculopathy. In such cases, lifting the arm often results in symptom relief. According to a case report, the shoulder abduction test can serve not only as a diagnostic tool but also as a conservative intervention strategy for patients with cervical radiculopathy involving the lower cervical nerve roots.[30]

Limitations

One of the main limitations of this study was the inability to use gold-standard objective measurement tools for the evaluated parameters-namely, pain and ROM. Due to financial constraints and practical considerations, pain was assessed using the VAS, and ROM was measured using a traditional universal goniometer. For future research, the use of more sensitive and advanced tools such as three-dimensional motion analysis systems is recommended. These technologies may enhance the reliability of the findings and provide more clinically applicable insights.

CONCLUSION

In the intervention group of our study, non-elastic taping was applied in a manner consistent with the shoulder abduction relief test. The painful-side shoulder was passively elevated to reduce tension on the nerve roots, and this position was maintained using non-elastic tape. Acute outcomes showed a reduction in pain and an increase in cervical ROM in the taped group. However, there were no statistically significant differences between the intervention and control groups, both of which received conventional physiotherapy. Non-elastic taping can be considered a simple, cost-effective, and easily applicable method that may serve as an adjunct to rehabilitation programs. In our study assessing the acute effects of non-elastic taping on pain and ROM, no superiority was found over standard conservative treatment alone. However, considering the mechanism of action-mechanical support and enhanced proprioception-non-elastic taping may offer improved clinical outcomes over the long term when integrated into conservative therapy programs. We believe that future studies with larger sample sizes and longer follow-

up periods are necessary to further explore and support the clinical utility of non-elastic taping. It is also recommended that future research include functional outcome measures specific to the cervical region. A better understanding of the underlying kinematic and neuroplastic mechanisms involved in cervical taping may help refine intervention strategies using this method.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Üsküdar University Non-interventional Researches Ethics Committee (Date: 23.02.2023, Decision No: 61351342/2023-51).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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