ISSN: 2321-5690
IJOPT
INDIAN JOURNAL OF PHYSICAL THERAPY
AN INTERNATIONAL JOURNAL
INDIAN JOURNAL OF PHYSICAL THERAPY
AN INTERNATIONAL JOURNAL
editor.ijopt@gmail.com

"EFFECT OF STRENGTHENING VS CONTRAST THERAPY ON CHRONIC LOW BACK PAIN IN DESKTOP WORKERS: AN INTERVENTIONAL STUDY"

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DOI: https://doi.org/10.63299/ijopt.0060478

ABSTRACT

Background: Chronic low back pain (CLBP) is a common musculoskeletal disorder and a leading cause of disability worldwide, particularly among desktop workers exposed to prolonged sitting and poor ergonomics. Sedentary posture leads to muscle imbalance, reduced spinal stability, and persistent pain. Effective management strategies that address both pain and function are essential for this population.
Objective: This study aimed to compare the effects of muscle strengthening exercises and contrast therapy on pain intensity and functional disability among desktop workers with chronic low back pain.
Methodology: Thirty participants aged 30 - 45 years with CLBP were randomly divided into two groups: Group A (Strengthening Exercise Group) and Group B (Contrast Therapy Group), with 15 participants each. Both groups received conventional stretching, while Group A performed core-strengthening exercises, and Group B received contrast therapy using alternating hot and cold packs. The intervention was conducted five days per week for four weeks. Pain and functional outcomes were assessed using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI). Data were analyzed using paired and unpaired t-tests, with a significance level of $p < 0.05$.
Results: Both groups showed significant improvements in VAS and ODI scores post-intervention ($p < 0.05$). Between-group analysis revealed that contrast therapy produced greater short-term improvement in pain and disability compared to strengthening exercises ($p < 0.001$).
Conclusion: Both interventions effectively reduced pain and improved function in desktop workers with CLBP. Contrast therapy provided superior short-term relief, while strengthening exercises enhanced long-term spinal stability. A combined approach is recommended for optimal rehabilitation outcomes.
Key words: Chronic low back pain, contrast therapy, strengthening exercises, occupational health, pain relief, Oswestry Disability Index, Visual Analogue Scale, physiotherapy.

INTRODUCTION

Chronic low back pain (CLBP) is defined as pain persisting for more than 12 weeks or beyond the normal healing period, representing one of the most prevalent and disabling musculoskeletal disorders worldwide. [1] It affects nearly 60–80% of individuals at some point in their lifetime and remains a major cause of functional limitation, absenteeism, and reduced productivity. [2] Among occupational groups, desktop workers represent a particularly high-risk population due to prolonged sitting, static postures, inadequate lumbar support, and limited opportunities for movement. These ergonomic and lifestyle factors contribute to muscle imbalance, reduced spinal stability, and chronic discomfort that often evolves into persistent low back pain if not addressed effectively. [3]

According to the Global Burden of Disease (GBD) Study 2019, low back pain remains the leading cause of years lived with disability globally, especially among working-age adults. [4] The widespread adoption of computer-based professions, remote work, and sedentary lifestyles has further intensified the burden of CLBP. In India, the rapid growth of the IT and service sectors has led to an increasing incidence of occupational low back pain, making it a pressing public health and ergonomic concern. [5]

CLBP is multifactorial in origin, with contributions from mechanical, neuromuscular, and psychosocial factors. Prolonged sitting increases intradiscal pressure, weakens core musculature, and reduces spinal joint mobility, predisposing individuals to chronic pain. In addition, psychosocial stressors such as job strain and reduced physical activity exacerbate pain perception and delay recovery. [6] Given these interrelated mechanisms, a multimodal rehabilitation approach combining active and passive treatment strategies is recommended to improve function and reduce recurrence.

Among various conservative management strategies, strengthening exercises play a pivotal role in restoring trunk stability and spinal alignment. Strengthening programs, particularly those targeting the deep stabilizing muscles such as the transversus abdominis and lumbar multifidus, enhance neuromuscular control, postural balance, and endurance, thereby reducing pain recurrence. [7] Evidence suggests that supervised core stabilization and progressive resistance training can significantly improve pain, range of motion, and quality of life among individuals with CLBP. [8] Elastic resistance bands offer a simple, inexpensive, and accessible means of implementing such strengthening programs both in clinical and home-based settings, making them particularly suited to busy professionals. [9]

Conversely, contrast therapy (CT) the alternating application of heat and cold has been used as a passive therapeutic modality to alleviate pain, inflammation, and muscle stiffness. The mechanism involves alternating vasodilation and vasoconstriction, promoting blood flow, metabolic waste removal, and tissue healing. [10] Contrast water therapy or the use of hot/cold packs has shown promise in managing soft tissue injuries and subacute musculoskeletal pain, but its application for chronic lumbar conditions in sedentary

populations remains relatively underexplored. [11] Unlike strengthening exercises that require active participation, contrast therapy provides an easy, non-invasive, and cost-effective option for pain relief and functional improvement.

Given that both strengthening and contrast therapy are feasible, safe, and widely used interventions, comparing their relative efficacy could help clinicians and occupational health practitioners determine optimal treatment strategies for desk-based workers with CLBP. While strengthening targets the neuromuscular mechanisms of spinal stability, contrast therapy acts primarily through neurovascular and analgesic pathways, providing potentially complementary benefits.

Despite the global awareness of ergonomics and preventive strategies, many professionals continue to experience recurrent back pain episodes due to long working hours and poor postural habits. As these issues not only affect physical health but also influence productivity and mental well-being, effective intervention models tailored to this occupational group are critically needed. [12] Furthermore, the lack of studies directly comparing active (exercise-based) and passive (thermal-based) modalities among Indian desk workers highlights a significant research gap.

AIM AND OBJECTIVES: The present study aims to determine the effect of muscle strengthening exercises and contrast bath therapy on chronic low back pain among desktop workers. Specifically, the objectives were to assess the impact of both contrast therapy and strengthening exercises on pain and functional outcomes in individuals with chronic low back pain, and to compare the effectiveness of these two interventions in reducing pain intensity and improving function among desktop workers experiencing chronic low back discomfort.

METHODOLOGY

Study Design: This study was designed as an experimental interventional study conducted to compare the effects of muscle strengthening exercises and contrast therapy on chronic low back pain (CLBP) among desktop workers. The total duration of the study was 4-6 weeks, and all procedures were performed at the Physiotherapy Outpatient Department.

Participants: A total of 30 participants aged between 30-45 years, all of whom were regular computer users (≥4 hours/day) with a pain duration of more than 4 weeks, were recruited for the study. Participants were randomly divided into two groups:

- Group A (Strengthening Exercise Group) = 15
- Group B (Contrast Therapy Group) = 15

Participants were recruited from various industries and organizations employing desktop workers, including both full-time and part-time employees. Prior to inclusion, each participant provided informed written consent, and confidentiality was maintained throughout the study.

Inclusion and Exclusion Criteria: Participants included in this study were adults aged between 30 and 45 years who were regular computer users, spending a minimum of four hours per day engaged in desktop work. Individuals experiencing chronic low back pain (CLBP) with a pain duration of more than four weeks were selected for participation. Participants were excluded if they had a history of lumbar spine surgery or trauma, any systemic neurological or muscular disorders, skin hypersensitivity, vascular conditions, or if they were pregnant.

Intervention: All participants in both groups received conventional stretching exercises before the main intervention to reduce muscle tightness.

Conventional therapy included: Hamstring stretch, Hip flexor stretch, Piriformis stretch

Group A: Strengthening Exercise Group: Participants in this group performed a structured core muscle strengthening program targeting the trunk and abdominal stabilizers. The exercises included:

1. Partial Curl-Ups: Participants lay supine with knees bent and feet flat on the floor, arms across the chest or along the thighs. They curled up to lift the head and shoulders for 2- 3 seconds before returning to the starting position.

2. Pelvic Bridging: Participants lay on their back with knees bent, feet hip-width apart, and lifted their hips by tightening the abdominal and gluteal muscles, holding for 3 - 5 seconds before lowering.

3. Bird Dog (Quadruped Limb Raise): Starting on all fours, participants raised one arm and the opposite leg while maintaining a neutral spine, then alternated sides.

All strengthening exercises were performed five days per week for four weeks under supervision, with gradual progression based on tolerance.

Group B: Contrast Therapy Group: Participants received contrast bath therapy, which involved the alternate application of heat and cold packs to the lower back region.

- Hot pack (40 - 50°C) applied for 3 - 4 minutes
- Cold pack (0 - 10°C) applied for 1- 2 minutes

This alternation was repeated for a total duration of 20 minutes per session, followed by the same set of conventional stretching exercises. The therapy was administered five days per week for four weeks. The physiological principle of contrast therapy is to produce alternating vasodilation and vasoconstriction, thereby improving blood circulation, reducing inflammation, and promoting metabolic recovery.

Outcome Measures: Pain intensity and functional outcomes were measured before and after the 4-week intervention using standardized tools.

- Primary Outcome Measure: Visual Analogue Scale (VAS) - for pain intensity
- Secondary Outcome Measures: Functional status and flexibility assessed through standard clinical evaluation tools relevant to CLBP management.

Procedure: Participants who met the inclusion criteria were recruited from various industries and organizations employing desktop workers, including both full-time and part-time employees. Informed consent was obtained from all participants before inclusion in the study. Data were collected using standardized questionnaires to record demographic details, work-related factors, and symptoms of chronic low back pain (CLBP), which was diagnosed based on pain duration of more than four weeks. Ethical standards were maintained by ensuring confidentiality and data privacy throughout the research. Pain intensity was assessed for each participant, and individual data were documented. Participants were then randomly assigned to either the strengthening or contrast therapy group. Both groups received conventional stretching exercises to relieve muscle tightness and improve flexibility, while Group A additionally performed a structured strengthening exercise program. Pain outcomes were evaluated using the Visual Analogue Scale (VAS).

Statistical Analysis: Data collected before and after the intervention were analysed using Statistical Package for the Social Sciences (SPSS) version 25.0. The normality of data was tested using the Shapiro–Wilk test. For within-group comparisons, the paired t-test was applied, while unpaired t-tests were used for between group comparisons. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Mean and Standard Deviation of Age in Both Groups

Variable	Group A (Strengthening Group)	Group B (Contrast Therapy Group)
Mean Age (years)	37.80	37.53
Standard Deviation (SD)	4.60	5.18

Chart 1: Gender distribution of both groups

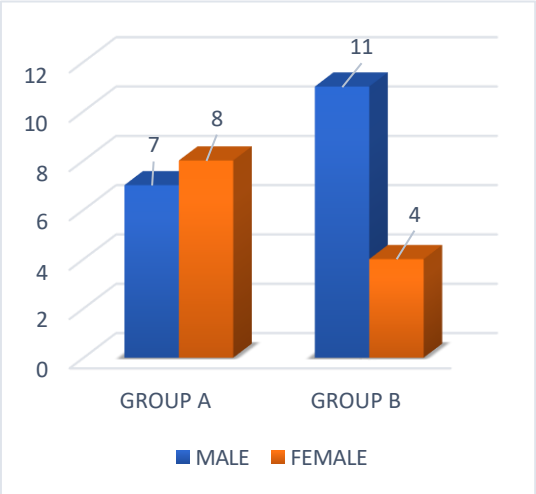
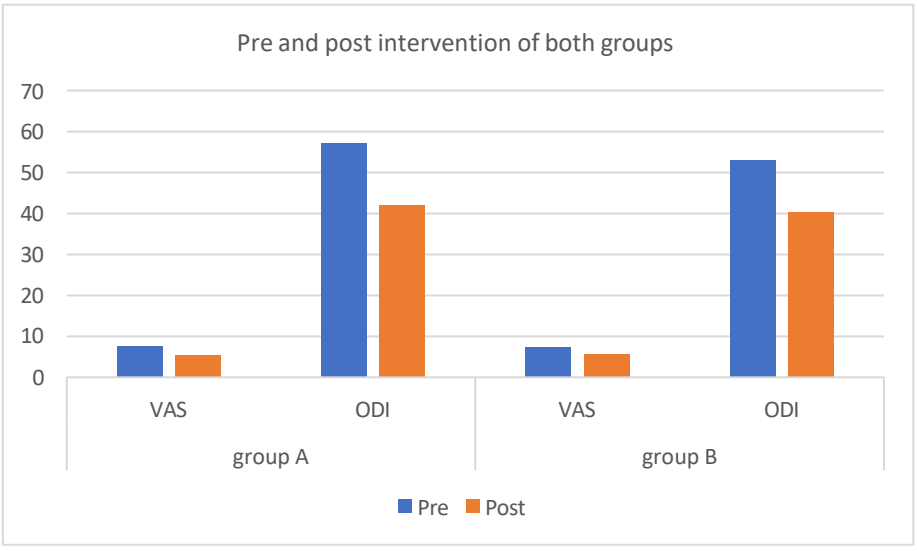


Table 2: Pre and Post Intervention Comparison of VAS and ODI Scores Within Each Group

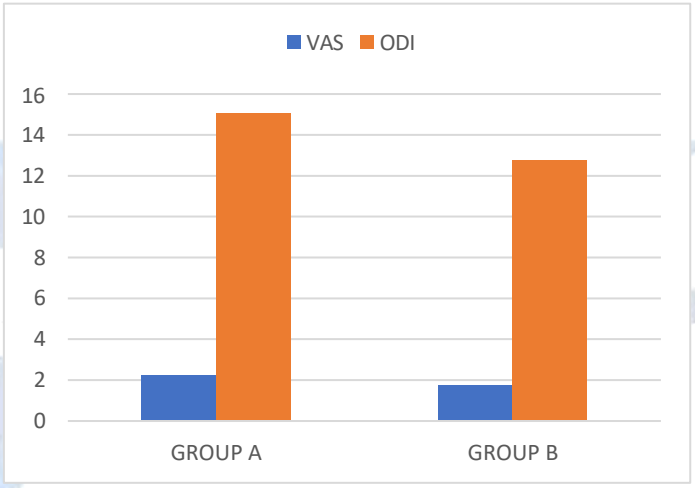
Groups	Outcome Measure	Pre-Intervention (Mean ± SD)	Post-Intervention (Mean ± SD)	t-value	p-value
Strengthening (Group A)	VAS	7.61 ± 1.21	5.37 ± 1.41	16.52	< 0.0001
	ODI	57.15 ± 6.24	42.11 ± 6.24	10.34	< 0.001
Contrast Therapy (Group B)	VAS	7.36 ± 1.09	5.61 ± 1.20	15.43	< 0.015
	ODI	53.00 ± 8.45	40.27 ± 8.35	8.45	< 0.019



Both groups showed a statistically significant reduction in pain (VAS) and disability (ODI) scores after the intervention. However, the strengthening group (Group A) demonstrated greater improvement compared to the contrast therapy group (Group B), indicating that strengthening exercises were more effective in reducing chronic low back pain and functional disability among desktop workers.

Table 3: Comparison of VAS and ODI Between Groups

Outcome Measure	Group	Mean ± SD	t-value	p-value
VAS	Group A	2.24 ± 0.20	6.72	< 0.0001
	Group B	1.75 ± 0.11		
ODI	Group A	15.04 ± 1.30	5.89	< 0.001
	Group B	12.73 ± 0.10		



The between-group comparison revealed a statistically significant improvement in both VAS and ODI scores. Group B showed greater reduction in pain and disability levels compared to Group A ($p < 0.001$), indicating superior effectiveness of the intervention used in Group B.

DISCUSSION

The statistical analysis revealed a significant reduction in pain intensity and functional disability following both strengthening exercises and contrast therapy interventions among desktop workers with chronic low back pain (CLBP). Within-group analysis showed that both Group A (Strengthening Exercise Group) and Group B (Contrast Therapy Group) demonstrated statistically significant improvements in Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) scores after 4 weeks of intervention ($p < 0.05$). Between-group comparison further indicated a highly significant difference in VAS ($p < 0.0001$) and ODI ($p < 0.001$) scores, where Group B exhibited greater improvement in pain and disability levels than Group A. These findings suggest that while both interventions were effective, contrast therapy produced superior short-term benefits

in pain relief and functional recovery compared to strengthening exercises in sedentary desktop workers with CLBP.

Our results are consistent with previous studies that reported significant improvement in pain and function following multimodal physiotherapy interventions for chronic low back pain. Alsaadi et al. (2019) demonstrated that both active exercises and thermal modalities reduce pain perception through neuromuscular and circulatory mechanisms, enhancing patient-reported outcomes. [13] Similarly, Kumar et al. (2018) found that strengthening programs targeting core and trunk muscles improve spinal stability and reduce lumbar disability among office workers. [14] The greater reduction in pain in our contrast therapy group aligns with findings by Nadler et al. (2004), who noted that alternating heat and cold application increases local blood flow, accelerates tissue repair, and provides rapid analgesic effects through thermoregulatory mechanisms. [15]

The underlying mechanisms of the observed improvements may be attributed to the distinct physiological effects of both interventions. Strengthening exercises enhance activation and endurance of stabilizing muscles such as the transversus abdominis and multifidus, which play a crucial role in maintaining spinal alignment and load distribution. Regular activation of these muscles improves postural control, reduces strain on passive spinal structures, and decreases recurrence of pain episodes. [16] In contrast, contrast therapy induces alternating vasodilation and vasoconstriction, which enhances circulation, reduces muscle spasm, and promotes metabolic waste clearance, thereby lowering pain sensitivity and inflammation. This thermal cycling may have contributed to the faster pain relief and functional gain observed in the contrast therapy group. [17]

Several authors have emphasized the role of sedentary behavior and poor ergonomics in precipitating CLBP among desk workers. Studies by Szeto et al. (2020) and Shariat et al. (2018) highlighted that prolonged sitting, weak trunk musculature, and limited lumbar motion significantly increase the risk of musculoskeletal discomfort and chronic spinal pain. [18,19] Our findings support these observations, demonstrating that targeted interventions addressing both muscular weakness and circulatory limitations can yield meaningful clinical improvements in this population. Furthermore, the improvements in ODI scores indicate not only pain relief but also better performance in daily and occupational activities, reflecting a positive impact on functional independence.

The greater benefit observed with contrast therapy in our study may also be related to its passive nature and immediate analgesic effect, which can enhance compliance among desk workers with limited time or exercise tolerance. However, long-term improvements in spinal stability and recurrence prevention are likely to depend more on strengthening-based interventions. Therefore, an integrated approach combining both active and passive modalities might provide optimal outcomes for managing chronic occupational low back pain.

From a clinical perspective, these results have important implications for physiotherapists and occupational health practitioners. Incorporating contrast therapy sessions during acute pain phases, followed by progressive strengthening exercises, may provide a balanced strategy for symptom control and long-term functional restoration. Additionally, ergonomic modifications, postural education, and regular stretching can complement these interventions to prevent relapse and promote spinal health in sedentary professionals.

CONCLUSION

Both strengthening exercises and contrast therapy effectively reduced pain and disability in desktop workers with chronic low back pain. Contrast therapy provided greater short-term pain relief, likely due to its circulatory and analgesic effects, while strengthening exercises offered long-term benefits by improving spinal stability and posture. An integrated approach combining both methods is recommended for optimal management of occupational low back pain.

ACKNOWLEDGEMENT: I express my deepest gratitude to Almighty God for His blessings and guidance throughout this research. My heartfelt thanks to my parents, Meenaben and Rajendrakumar Umaraniya, for their constant love, motivation, and support. I extend sincere appreciation to Dr. Manisha Rathi, Principal and Professor, Venus Institute of Physiotherapy, for her encouragement and permission to conduct this study, and to my guide Dr. Tanuja Pandya for her invaluable guidance and support. I am thankful to all faculty members and participants whose cooperation made this research possible, and to everyone who contributed directly or indirectly to the successful completion of this work.

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