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ORIGINAL ARTICLE

EFFECT OF MOTOR CONTROL EXERCISES VERSUS MCGILL'S STABILIZATION EXERCISES ALONG WITH INTERFERENTIAL THERAPY ON PAIN AND DISABILITY IN PATIENTS WITH CHRONIC LOW BACK PAIN: A COMPARATIVE STUDY

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ABSTRACT

Background & objectives: Chronic low back pain (CLBP) is a persistent musculoskeletal condition associated with pain, functional limitation and disability. Motor control exercises focus on retraining the deep trunk muscles and progressing toward coordinated functional tasks, whereas McGill's stabilization exercises emphasize spinal stability through low-load exercises. The present study compared the effects of these two exercise approaches, with interferential therapy (IFT) used in both groups, on pain and disability in patients with CLBP. **Methods:** Fifty patients with CLBP were screened and 40 participants who met the eligibility criteria were included. Participants were selected by purposive sampling and allocated into two groups of 20 each. Group A received motor control exercises with IFT, while Group B received McGill's stabilization exercises with IFT. Both groups received three sessions per week for six weeks; IFT was provided for the first 10 days. Pain and disability were assessed before treatment and after six weeks using the visual analog scale (VAS) and Quebec Back Pain Disability Scale (QBPDS), respectively. Within-group changes were examined using paired-sample t-tests and between-group changes using independent-samples t-tests. **Results:** Both groups demonstrated significant within-group reductions in VAS and QBPDS scores. In Group A, mean VAS decreased from 4.90 ± 0.64 to 2.80 ± 0.83 and mean QBPDS decreased from 25.85 ± 4.76 to 13.45 ± 3.10 ($p < 0.001$ for both). In Group B, mean VAS decreased from 4.95 ± 0.69 to 3.50 ± 0.76 and mean QBPDS from 26.65 ± 4.79 to 17.80 ± 1.82 ($p < 0.001$ for both). Between-group analysis showed greater mean reductions with motor control exercises for VAS (2.10 vs 1.45 ; $t = -2.45$, $p = 0.019$) and QBPDS (12.40 vs 8.85 ; $t = -2.15$, $p = 0.038$). **Conclusion:** Motor control exercises combined with IFT produced significantly greater reductions in pain and disability than McGill's stabilization exercises combined with IFT in this sample of patients with CLBP.

Keywords: Musculoskeletal disorders, Nordic Musculoskeletal Questionnaire, movement and function

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INTRODUCTION

Low back pain (LBP) is a common and disabling musculoskeletal problem. It may present with pain, muscle tension or stiffness and can affect physical function, occupational activities and quality of life. Chronic low back pain is generally defined in the thesis as pain persisting for 12 weeks or more. The condition has a substantial functional and economic burden and is influenced by physical as well as psychological factors¹⁻⁴.

The relationship between pain and disability in LBP is complex because pain is subjective and multidimensional. Disability may be reflected in limitations in self-care, walking, lifting, sitting, standing, sleeping, travelling, social activities and work-related tasks⁵. The thesis describes CLBP as a condition in which alterations in trunk muscle activation and spinal stability may contribute to persistent symptoms.

The trunk musculature contributes to spinal stability through coordinated activity of deep and superficial muscle systems. The deep trunk muscles, particularly the transversus abdominis and lumbar multifidus, have an important role in controlling intervertebral motion. In people with LBP, altered motor-control strategies and delayed or reduced activation of deep muscles have been described in the literature reviewed in the thesis⁶⁻⁹.

Motor control exercise is directed toward restoring the coordinated activation of the deep trunk muscles. The approach begins with isolated activation in low-load positions and progresses to tasks requiring coordination of deep and superficial trunk muscles while maintaining a neutral lumbar position. The thesis review reports evidence supporting motor control exercise for reducing pain and disability in CLBP¹⁰⁻¹³.

McGill's stabilization approach is based on creating spinal stability through low-load exercises that recruit muscles surrounding the spine. The commonly described McGill "Big Three" are the curl-up, side plank and bird-dog. The approach aims to develop spinal stiffness and stability while minimizing excessive spinal loading. Previous work reviewed in the thesis has reported beneficial effects of McGill stabilization exercises on pain and functional disability¹⁴.

Interferential therapy (IFT) is used as an electrotherapeutic intervention for musculoskeletal pain. The thesis describes its use in both treatment groups so that the exercise programs could be compared with IFT as a common component^{15,16}. Although both motor control and McGill stabilization exercises are used clinically for CLBP, the thesis identified a need to compare their effects when combined with the same IFT protocol.

Therefore, the present study was undertaken to compare motor control exercises and McGill's stabilization exercises, both combined with IFT, on pain and disability in patients with chronic low back pain.

METHODOLOGY

Study design and setting: A comparative study was conducted in the physiotherapy outpatient department of Raja Rajeswari Medical College and Hospital, Bengaluru. The total study duration was 10 months. Individual treatment was delivered over six weeks, with three sessions per week.

Ethical considerations: Institutional Ethical Committee clearance was obtained from Raja Rajeswari Medical College and Hospital, Bengaluru. The study was registered with Rajiv Gandhi University of Health Sciences under registration number 09_T055_148888. Written

informed consent was obtained from all participants before participation.

Participants and sampling: Fifty subjects diagnosed with chronic low back pain were screened. Forty participants who fulfilled the eligibility criteria and agreed to participate were included. The thesis describes purposive sampling and allocation into two groups of 20 participants each, with alternate allocation during the treatment period. Participants were blinded to the intervention group after allocation, and no dropouts were reported.

Eligibility criteria: Participants were aged 25–35 years, had chronic low back pain of ≥ 12 weeks associated with intervertebral disc prolapse (stage 1: degeneration), VAS scores of 4–6, QBPDS scores of 20–40, low-risk Start Back Screening Tool scores as specified in the thesis, and BMI of 18.5–24.9 kg/m². Both male and female participants were eligible. Exclusion criteria included previous spinal or rib fracture/injury, spinal or limb deformity, recent abdominal or spinal surgery or implants, pregnancy, specific spinal pathology, relevant comorbidities preventing exercise participation, visual impairment or hearing loss, and obesity.

Outcome measures: Pain intensity was assessed using the visual analog scale (VAS), a 10-cm scale ranging from no pain to extreme pain. Disability was assessed using the Quebec Back Pain Disability Scale (QBPDS), a 20-item self-administered measure of activities affected by low back pain; higher scores indicate greater disability. The Start Back Screening Tool was used during screening.

Procedure: On day 1, participants underwent pre-intervention assessment of VAS and QBPDS. The allocated intervention was then provided three times per week for six weeks. The post-intervention assessment was completed at the end of the sixth week. A

single therapist delivered the intervention and performed the pre- and post-intervention assessments. Each session lasted approximately 60 minutes and included 10 minutes of IFT, a 5-minute warm-up, 30–40 minutes of exercise training, rest periods, and a 2-minute cool-down. Both groups received the same IFT before exercise for the first 10 days.

IFT protocol: Participants were positioned prone with the painful area exposed. Tender points were identified by palpation and electrodes were positioned using a crossfire arrangement around the painful lumbar region. The thesis records use of a Vectrostrim IFT machine, a 4-kHz carrier frequency, burst frequency of 1–10 Hz, vector sweep of 900 V, patient-tolerated intensity, trapezoid waveform and 10-minute treatment duration.

Group A: Motor control exercises: The motor control program began with 6–8 cycles of cat-camel movement in quadruped. Participants were taught abdominal drawing-in manoeuvre (ADIM) to activate the deep abdominal musculature. Progression moved from low-load positions to sitting, standing and quadruped activities, followed by more challenging static, dynamic and functional tasks. Exercises described in the thesis included ADIM, bridging, straight-leg raise with ADIM, bird-dog and its progression, and side plank and its progression. The program emphasized maintaining a neutral spine and controlled activation of the trunk muscles.

Group B: McGill's stabilization exercises: Participants were first trained to identify and maintain a neutral spinal posture. The program began with cat-camel movement and ADIM, followed by the McGill stabilization exercises. The thesis protocol included curl-up, curl-up progression, bird-dog, bird-dog progression, side plank and side plank progression. The exercises were progressed according to the

treatment schedule while maintaining spinal control.

Statistical analysis: Data were analyzed using R software version 4.4 and Microsoft Excel. Descriptive statistics were used for age, BMI, VAS and QBPDS, while frequency distributions were used for categorical variables. Paired-sample t-tests were used for within-group comparisons and independent-samples t-tests for between-group comparisons. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 50 subjects were screened and 40 eligible participants completed the study, with 20 participants in each group. Both groups had an equal distribution of male and female participants (50% each). Baseline descriptive characteristics and outcome scores are presented below.

Variable	Group A (MCE+IFT)	Group B (McGill+IFT)	Mean difference	Interpretation
Age, mean $\pm$ SD (years)	31.20 $\pm$ 3.96	30.40 $\pm$ 3.99	0.80	Comparable baseline age
BMI, mean $\pm$ SD (kg/m ²)	22.15 $\pm$ 1.76	23.18 $\pm$ 1.41	-1.03	Within eligibility range
VAS pre, mean $\pm$ SD	4.90 $\pm$ 0.64	4.95 $\pm$ 0.69	-0.05	Similar baseline pain
QBPDS pre, mean $\pm$ SD	25.85 $\pm$ 4.76	26.65 $\pm$ 4.79	-0.80	Similar baseline disability
Gender	50% male; 50% female	50% male; 50% female	—	Equal distribution

Table 1. Baseline demographic and outcome characteristics

Outcome	Group	Pre-test mean $\pm$ SD	Post-test mean $\pm$ SD	t value	p value
VAS	Group A	4.90 $\pm$ 0.64	2.80 $\pm$ 0.83	10.30	<0.001
QBPDS	Group A	25.85 $\pm$ 4.76	13.45 $\pm$ 3.10	12.52	<0.001
VAS	Group B	4.95 $\pm$ 0.69	3.50 $\pm$ 0.76	8.54	<0.001
QBPDS	Group B	26.65 $\pm$ 4.79	17.80 $\pm$ 1.82	6.68	<0.001

Table 2. Within-group comparison of VAS and QBPDS scores.

Outcome	Group A mean change	Group B mean change	t value	p value	Inference
VAS	-2.10 (reduction 2.10)	-1.45 (reduction 1.45)	-2.45	0.019	Significant
QBPDS	-12.40 (reduction 12.40)	-8.85 (reduction 8.85)	-2.15	0.038	Significant

Table 3. Between-group comparison of changes in outcome measures

Within-group analysis showed significant improvement in both groups for pain and disability. Group A showed a mean VAS reduction of 2.10 points and a mean QBPDS reduction of 12.40 points. Group B showed mean reductions of 1.45 and 8.85 points, respectively. The between-group comparisons demonstrated significantly greater mean reductions in both VAS and QBPDS in Group A.

DISCUSSION

The present study compared two exercise-based approaches for patients with chronic low back pain, with IFT provided as a common treatment component. Both groups demonstrated statistically significant reductions in pain and disability after six weeks. The greater reductions observed in the motor control group suggest that a program emphasizing specific activation and coordination of deep trunk muscles may provide additional benefit in this selected sample.

Pain intensity was similar between groups at baseline, with mean VAS scores of 4.90 in Group A and 4.95 in Group B. After treatment, the mean VAS decreased to 2.80 in Group A and 3.50 in Group B. The between-group difference in mean change was statistically significant ($p=0.019$), with a larger mean reduction in Group A. This finding is consistent with the literature summarized in the thesis, including evidence that motor control exercise can reduce pain in people with chronic low back pain¹⁰.

The improvement may be related to the primary aim of motor control exercise: retraining the deep trunk muscles separately and then integrating them into more demanding tasks. The thesis review emphasizes the role of transversus abdominis and multifidus in intervertebral control and describes altered activation strategies in CLBP [6–9]. Gradual progression from ADIM in low-

load positions to functional tasks may therefore improve the patient's ability to control lumbar movement during activity¹¹.

Disability also improved significantly in both groups. QBPDS scores decreased from 25.85 to 13.45 in Group A and from 26.65 to 17.80 in Group B. The between-group comparison showed a greater mean reduction with motor control exercise (12.40 versus 8.85; $p=0.038$). The findings are in agreement with the thesis literature review, which reports beneficial effects of motor control exercise on disability and functional outcomes in CLBP^{12,13}.

McGill's stabilization exercises also produced significant improvements. The McGill approach used in this study incorporated the curl-up, side plank and bird-dog, together with neutral-spine training and ADIM. Previous work reviewed in the thesis, particularly the study by Ghorbanpour et al., reported improvements in pain and functional disability following McGill stabilization exercise. The current results similarly indicate that McGill stabilization exercises are a useful exercise-based approach, although the motor control program produced larger mean changes in this study¹⁴⁻¹⁷.

IFT was applied identically in both groups and therefore does not explain the difference between the exercise programs. The thesis describes IFT as a common component intended to address pain before exercise. The systematic review cited in the thesis provides evidence concerning the use of interferential current therapy in musculoskeletal pain¹⁸⁻²⁰.

Taken together, the findings indicate that both approaches can improve pain and disability over six weeks, while motor control exercises combined with IFT may offer a greater short-term effect than McGill stabilization exercises combined with IFT in the studied population. The result should be interpreted within the characteristics of the sample and the methodological limitations of the study^{21, 22}.

Limitations:

The sample size was small, limiting generalizability.

The study used a limited set of outcome measures and did not directly assess deep and superficial trunk muscle activation.

Long-term follow-up was not performed.

Recommendations:

Future studies should include longer follow-up periods.

Larger samples and broader participant characteristics should be considered to improve generalizability.

Future studies may incorporate objective measures of deep and superficial trunk muscle activation.

CONCLUSION

The present study found that both motor control exercises with IFT and McGill's stabilization exercises with IFT significantly improved pain and disability in patients with chronic low back pain. However, motor control exercises combined with IFT produced significantly greater reductions in VAS and QBPDS scores than McGill's stabilization exercises combined with IFT over the six-week intervention period.

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Conflict Of Interest: The thesis reports no conflict of interest.

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