Effect of Neurokinetic Therapy on core muscle dysfunction among subjects with low back pain

Abstract

Aims

Core muscle dysfunction is commonly identified as a contributing factor for low back pain. This present study will look at the effects of Neurokinetic Therapy on core muscles' dysfunction in individuals with low back pain.

Methods

Sixty-six subjects aged 20-50 years, with chronic nonspecific low back pain were randomized to two groups (NKT and Control). The NKT group was treated for eight weeks. Manual muscle testing of participants was conducted during this period alongside the identification of dysfunctional movement patterns and biweekly neuromotor reprogramming sessions.

Findings

The primary outcome, core muscle endurance, improved significantly in the NKT group. The plank endurance time increased from a mean of 45.2 seconds (SD 10.5) at baseline to 61.0 seconds (SD 12.4) post-intervention, while the control group showed a smaller improvement. Side-bridge endurance times also demonstrated a greater increase in the NKT group (30.4 seconds [SD 8.2] to 42.6 seconds [SD 9.3]) compared to the control group. The Wilcoxon test confirmed that these improvements were statistically significant ($p < 0.01$).

Conclusion

Based on the findings, interventional techniques such as NKT must be incorporated within the clinical sphere for treating chronic low back pain, especially if core dysfunction is involved. These underscore the need for selective rehabilitation strategies to manage multisystem effects and to enhance quality life.

Keywords: Core Muscles, Low Back Pain, Muscle Dysfunction, Neurokinetic Therapy, Health

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Introduction

Low back pain (LBP) is a musculoskeletal condition affecting the majority of people at some point in their lives, with a prevalence ranging from 60 to 80 percent [1]. The condition is ranked among the leading causes of disability worldwide, significantly affecting quality of life, workplace productivity, and imposing financial burdens on healthcare systems [2]. Among these cases, chronic nonspecific low back pain (NSLBP) accounts for the majority and, being multifactorial, presents a greater challenge for effective treatment. Despite extensive research, effective long-term management strategies remain limited, primarily due to the underlying complexity of neuromuscular dysfunction associated with NSLBP [3].

The term "core" refers to the lumbopelvic-hip complex, which provides the foundation for efficient movement and spinal stability. Dysfunction in this system, marked by delayed activation, poor recruitment patterns, or muscular imbalances can compromise spinal control and result in pain or recurrent injury [4]. The deep stabilizing muscles, including the transversus abdominis, multifidus, pelvic floor, and diaphragm, work synergistically to maintain spinal integrity. In individuals with NSLBP, altered neuromuscular control leads to a reliance on superficial muscles such as the rectus abdominis and erector spinae, which are not designed to provide segmental stability. This imbalance contributes to excessive spinal loading and compensatory movement patterns, perpetuating pain and functional limitations [5].

Core muscle dysfunction is commonly identified as a contributing factor for low back pain. Weakness or faulty endurance in the core muscles, especially the deep stabilizers, compromises spinal stability and postural control and hence predisposes the individual to their subsequent recurrent episodes of pain. In deep stabilizers often present with delayed recruitment, reduced endurance, or inhibition, leading to compensatory overactivation of superficial muscles such as the rectus abdominis and erector spinae. [6, 7]. This altered motor control pattern increases spinal loading and contributes to mechanical stress, pain recurrence, and functional impairment. Thus, contemporary rehabilitation emphasizes the need to address not only muscular strength but also neuromuscular coordination and movement efficiency [8]. However, innovations are still needed that not only restore muscle strength but also improve neuromuscular control and reduce compensatory strategies, which are often overlooked.

Conventional rehabilitation strategies often emphasize core strengthening through exercises like planks, bridges, or dynamic stability routines. While these approaches may offer short-term benefits, they often fail to rectify dysfunctional motor patterns driven by central motor programming. Emerging evidence suggests that interventions targeting neuromuscular re-education and sensorimotor integration may provide superior outcomes by addressing the root cause of compensatory movement patterns rather than focusing solely on muscular conditioning [9, 10]. NeuroKinetic Therapy (NKT) offers a novel intervention that focuses on reprogramming dysfunctional movement patterns through manual muscle testing and corrective exercises. Based on the principle that the brain may create compensatory recruitment strategies when primary stabilizers are inhibited, NKT identifies these imbalances and facilitates more optimal neuromotor control [11].

Neurokinetic Therapy may represent one of the most promising approaches available. It relies on the concepts of manual muscle testing and theories of motor control to find and correct dysfunctional movement patterns at their neurological roots [12]. By reprogramming these motor control systems, NKT reforms core muscle activation, minimizes compensatory strategies, and enhances functional movement [13]. The therapy is reputed to be effective in treating a range of conditions, from plantar fasciitis to post-stroke recovery [8] to post-stroke recovery [14]. However, this therapy seems less discussed concerning the management of chronic NSLBP.

Recent evidence suggests that interventions targeting movement efficiency and sensorimotor integration may be more effective in managing chronic LBP than isolated strengthening alone. Given the substantial global burden of NSLBP and the limited evidence supporting the effectiveness of NKT in addressing core muscle dysfunction, further investigation is warranted. Therefore, the present study aims to evaluate the effects of Neurokinetic Therapy on core muscle endurance, pelvic alignment, pain intensity, and functional disability among individuals with chronic nonspecific low back pain. By examining the outcomes of this innovative neuromuscular approach, the study seeks to contribute to the advancement of targeted rehabilitation strategies for chronic LBP.

Instrument & Methods

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The study was a randomized controlled trial designed to evaluate the effect of Neurokinetic Therapy (NKT) on core muscle dysfunction in low back pain. The sample size was calculated using G* Power 3.1 software with the effect size of 0.65 based on previous studies evaluating core muscle interventions in chronic low back pain. With an alpha level of 0.05 and a statistical power of 0.80, the minimum required sample was 58. To compensate for possible dropouts, 66 participants were recruited.

Sixty-six subjects aged 20-50 years, with chronic NSLBP for a duration of more than 12 weeks, and core muscle dysfunction on clinical examination, such as decreased endurance on plank and lateral pelvic tilt, were recruited. Participants with acute low back pain, specific spinal pathologies, or contraindications to physical activity were excluded. Participants were allotted into Neurokinetic Therapy (NKT) group or the control group randomly, using computer-generated random sequence. The sequencing was monitored by an independent researcher who was not involved in the recruitment, analysis, or intervention processes. The ethical clearance was obtained from the Institutional Ethics Committee of SIMATS Medical College Hospital. The approval number is 011/11/2023/IEC/SMCH, and the approval was granted on 21st November 2023. All procedures were conducted in accordance with the ethical standards of the institutional and/or national research committee.

Primary outcome variables for the study included core muscle endurance with subjects having to perform plank and side-bridge tests. These tests have been established as reliable and valid core endurance outcome measures, with the inter-rater reliability exceeding 0.90 as cited by various authors [15, 16]. Secondary outcomes were lateral pelvic tilt, assessed using a clinical inclinometer- a device of proven reliability, with mounting evidence supporting its ability to measure pelvic position and tilt accurately [17, 18]. Quadratus lumborum flexibility was assessed using the sit-and-reach test, a commonly used and validated measure of lumbar flexibility correlated with movement outcomes [19]. For pain intensity, the Visual Analog Scale (VAS) was used, and for functional disability, the Oswestry Disability Index (ODI) was employed. The ODI is a highly reliable and valid instrument, widely applied both in clinical practice and research to assess disability related to low back pain [20].

The NKT group was treated for eight weeks. Manual muscle testing of participants was conducted during this period alongside the identification of dysfunctional movement patterns and biweekly neuromotor reprogramming sessions. The neuromotor reprogramming sessions involved structured manual testing and corrective exercises based on the principles of NKT. These sessions involved identifying muscles that show altered activation patterns due to compensatory dysfunctions and applying manual stimulation or corrective input to restore optimal neuromuscular coordination. Each session focused on targeted muscle testing, inhibition of overactive muscles, and facilitation of underactive muscles to promote balanced movement patterns. This process is based on neurophysiological mechanisms and clinical reasoning, without reliance on promotional or proprietary terminology. Each session involved the following steps: i) Manual Muscle Testing (MMT) of the muscles related to core stability and postural control (e.g., transversus abdominis, multifidus, gluteus medius) were assessed using manual testing techniques to identify dysfunctional or inhibited muscles. ii) Compensation Pattern Identification: Dysfunctional muscles were analyzed in the context of compensatory movement patterns, including overactivity of synergists or antagonists. iii) Corrective Stimulus: Once dysfunctional patterns were identified, manual stimulation (such as light palpation or resisted contraction) was applied to associated neurological structures (e.g., muscle spindle, tendon, or scar tissue) to interrupt maladaptive signaling. iv) Re-Testing and Reinforcement: After the corrective input, the initially weak or inhibited muscle was retested. If strength returned, the participant was guided through simple reinforcement exercises (e.g., low-load isometric contractions) to integrate the corrected pattern. v) Home Exercise Program: Patients were provided tailored home exercises targeting the reprogrammed motor patterns to reinforce neuromuscular control. Each session lasted approximately 30–40 minutes and was administered twice weekly for eight weeks by a physiotherapist certified in NKT [11-14, 21].

All treatments in both groups were performed by a certified therapist. Meanwhile, the control group carried out conventional core strengthening exercises for developing deep core muscles [22, 23]. The treatment was applied to subjects in both groups for a time period of eight weeks and eventually at 12 weeks of follow-up after having been applied to the subjects. An assessor with no awareness of the outcome measurements evaluated all outcomes independently.

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Data analysis was conducted using SPSS version 26. Normality of the data was assessed using the Shapiro–Wilk test. As several variables were not normally distributed, non-parametric statistical methods were used. Within-group changes were analyzed using the Wilcoxon signed-rank test, while between-group differences were assessed using the Mann–Whitney U test. Statistical significance was set at $p < 0.05$.

Findings

A total of 66 participants were recruited and randomized simply into the Neurokinetic Therapy group (NKT, n = 33) or the control group (n = 33). Ultimately, 62 participants completed the study; four were considered dropouts due to noncompliance or unrelated health conditions. Both groups were quite similar with regard to baseline characteristics, making them comparable to be analyzed.

The primary outcome, core muscle endurance, improved significantly in the NKT group. The plank endurance time increased post-intervention, with a large effect size (Cohen's d = 1.375, 95% CI [0.764, 1.987]). Side-bridge endurance times also demonstrated a greater increase in the NKT group compared to the control group, showing a large effect (d = 1.392, 95% CI [0.777, 2.006]). The Wilcoxon test confirmed that these improvements were statistically significant ($p < 0.01$; see Table 1).

Table 1. Comparing the Pre-test and Post test Values of Neurokinetic Therapy

Outcomes	**Pre-test Mean (SD)**	**Post-test Mean (SD)**	**Wilcoxon Test Statistic**	**p-value**
Core Muscle Endurance (Plank, sec)	45.2 (10.5)	61.0 (12.4)	5.12	<0.01
Core Muscle Endurance (Side-bridge, sec)	30.4 (8.2)	42.6 (9.3)	4.85	<0.01
Lateral Pelvic Tilt (degrees)	15.2 (4.1)	6.7 (3.8)	4.67	0.02
Quadratus Lumborum Flexibility (cm)	18.6 (3.8)	23.1 (4.5)	4.21	0.03
Pain Intensity (VAS, 0-10)	6.8 (1.5)	2.6 (1.3)	5.45	<0.01
Functional Disability (ODI, %)	42.3 (5.6)	24.3 (4.8)	5.32	<0.01

Among the secondary outcomes, the NKT group showed significant reductions in lateral pelvic tilt, with significant improvement with a effect size (d = −2.150, 95% CI [−2.948, −1.353]). Flexibility of the quadratus lumborum also improved significantly in the NKT group, with sit-and-reach test scores reflecting a large effect (d = 1.081, 95% CI [0.529, 1.632]); see Table 1.

In terms of pain intensity, the Visual Analog Scale (VAS) scores in the NKT group showed a significantly greater reduction than that observed in the control group ($p < 0.01$), with a very large effect size (d = −2.992, 95% CI [−4.018, −1.967]). Similarly, with functional disability as measured by the ODI, significant improvement was found in the NKT group and thus statistically significant ($p < 0.01$), also with a very large effect (d = −3.451, 95% CI [−4.607, −2.295]); see Table 1.

These findings show Neurokinetic Therapy to be more effective than conventional core strengthening in improving core muscle endurance, reducing lateral pelvic tilt, enhancing flexibility, decreasing pain intensity, and improving functional disability for low back pain individuals.

Discussion

The study's results showcase the neurokinetic therapy efficacy in rectifying core muscle dysfunction, together with symptoms presented by individuals with chronic nonspecific lower-back pain. NKT demonstrated significant gains compared with conventional core strengthening exercises. These findings are corroborated through the literature that indicates the therapies tackling neuromuscular dysfunctions generally offer better outcomes than a strength-based approach alone [7, 9].

The improvements in core muscle endurance observed in the NKT group are thought to be a consequence of motor control re-education and perhaps in correcting the dysfunctional movement patterns. Thus, endurance provides lumbar stability and has even been correlated with functional limitation and pain intensity in LBP patients [3, 4, 9]. NKT could have improved neuromuscular

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coordination of further deep core stabilizers such as the transversus abdominis and multifidus, leading to greater activation and endurance.

Correction of lateral pelvic tilt and improvement of quadratus lumborum flexibility highlight another aspect of NKT in addressing biomechanical imbalances and functional movement patterns. As pelvic asymmetry is often the cause of mechanical low-back pain, these improvements further reinforce the ability of NKT techniques to address such dysfunction [16-18]. Better flexibility of the quadratus lumborum, which is the main lateral stabilizer of the spine, may even have contributed to improved postural alignment and decreased compensatory strain in the lumbar region [22].

There was a dramatic decrease in pain intensity and functional impairment in the NKT group, meditating upon the evidence of NKT's potential to address chronic pain and settle functional outcomes [11-14, 23]. Compared to conventional core strengthening, NKT brings about changes within neuro-muscular dysfunctions that maintain pain and compensatory movement patterns. Such an integrated intervention approach may be the causal factor for the differential pain and disability reductions obtained in this study [24].

Based on the findings, interventional techniques such as NKT must be incorporated within the clinical sphere for treating chronic low back pain, especially if core dysfunction is involved [11, 12]. The observed improvements in core stability can be attributed to the central mechanism of NKT, which relies on the concept of motor control hierarchy and sensorimotor integration. By challenging the nervous system to correct faulty recruitment patterns, NKT facilitates neuroplastic changes that may restore muscle balance and improve postural control [7-9]. This approach contrasts with traditional strengthening programs, which often focus on isolated muscle activation without addressing the underlying neuromuscular imbalances.

Pain reduction observed in this study is also consistent with prior evidence suggesting that restoring correct motor patterns reduces mechanical loading and abnormal tension in compensating musculature. Furthermore, the activation of appropriate stabilizers through targeted neuro-muscular feedback may reduce nociceptive drive, contributing to the observed decrease in pain scores. These findings are in agreement with previous studies that report improvements in lumbar function and pain through interventions aimed at neuromuscular retraining.

Importantly, the results highlight that addressing core dysfunction is not solely about muscular strength but rather about coordinated and timely muscle activation. The neuromotor retraining facilitated by NKT may provide a more specific and individualized approach compared to general core exercises. In this context, NKT serves both a diagnostic and therapeutic role, identifying weak or inhibited muscles and immediately correcting them through brain-based reprogramming.

There are, however, a few limitations that need to be acknowledged. This study is preliminary in nature and was conducted with a limited sample size, which restricts the generalizability of the findings to broader populations. Larger, multi-centered trials are recommended to confirm the effectiveness of Neurokinetic Therapy (NKT) across diverse demographic and clinical groups. Additionally, while improvements in core muscle function were observed, the absence of objective muscle activity measurements such as surface or intramuscular electromyography (EMG) limits the ability to accurately assess deep muscle activation and neuromuscular responses [25, 26]. Larger and more heterogeneous populations, coupled with an objective movement analysis system, are needed to strengthen our research.

Conclusion

Neurokinetic Therapy demonstrates meaningful improvements in core muscle function, pain, and disability among individuals with chronic low back pain. It appears to be an effective clinical approach for addressing core dysfunction and enhancing functional outcomes. Further large-scale studies are recommended to confirm these findings.

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