



Combined Effects of Postural Education, Therapeutic Massage, Segmental Stretching, and Motor Control Exercise in a 19-Year-Old Male with Chronic Back Pain and Kypholordotic Posture: A Case Report

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Abstract

Introduction: Sagittal spine malalignment has been linked with a number of health consequences including pain, disability, and suboptimal quality of life.

Case Presentation: We present a 19-year-old male with 3 years history of chronic back pain associated with kypholordotic posture. Upon examination, lumbar hyperlordosis and thoracic hyperkyphosis were mainly associated with muscular imbalance around the chest, upper back, and lumbopelvic-hip region. The patient received treatment comprising postural education (PE), therapeutic massage (TM), segmental stretching exercise (SSE), and motor control exercise (MCE) twice a week for 8 weeks. The patient demonstrated a significant improvement in lumbar lordotic (83.8° to 76.3°) and thoracic kyphotic (65.2° to 60.6°) curves as measured by flexible ruler, back pain (7.0 cm to 1.0 cm) as measured by visual analogue scale, spine ranges of motion (flexion: 5.2cm to 7.5cm; extension: 3.5cm to 4.7cm) as measured by modified Schober's test, and functional disability (46.7% to 20.0%) as measured by modified Oswestry disability index.

Conclusions: The results showed that the combination of PE, TM, SSE, and MCE was effective in improving sagittal spine alignment, back pain, spine range of movement, and function.

Keywords: Back Pain, Exercises, Disability, Posture

1. Introduction

Proper activation of the local and global muscles is crucial to providing stability and maintenance of energy-efficient posture during static and dynamic activities (1). Sustained faulty posture creates a strain on ligaments and muscles that indirectly affects curvatures of the spine and its stability. The sagittal alignment of the spine describes the ideal or normal curves of the spine (2). The lumbar lordotic curve (LLC) is closely related to the thoracic kyphotic curve (TKC) and contributes significantly to upright posture by maintaining the center of gravity and maximizing energy efficiency while minimizing the effect of gravity on joints, muscles, and ligaments (2).

Sagittal malalignment of the spine, in contrast, has been described as an exaggeration or deficiency of normal LLC or TKC (3) and reported to be a potent generator of pain and disability, as well as associated with suboptimal qual-

ity of life (2, 4). Hence, strategies that promote optimal alignment of the spine should be a concern for physiotherapists.

Among the variety of techniques used by physiotherapists to manage back disorders include soft tissue manipulation, exercises, and patient education. Although exercises such as motor control or specific stabilization are commonly incorporated with stretching to address pain and impairments associated with chronic back disorders (5), their application in conjunction with therapeutic massage and postural education has not been previously reported in the rehabilitation of chronic back pain associated with nonstructural postural misalignment. The systematic combination of these techniques might, therefore, provide positive reinforcement effects in dealing with such disorder as each technique targets a distinct aspect of back impairments.

This study was conducted to portray the efficacy of

combining postural education (PE), therapeutic massage (TM), segmental stretching exercise (SSE), and motor control exercise (MCE) in a 19-year old male with chronic back pain and kypholordotic posture.

2. Case Presentation

A 19-year-old male student was referred to physiotherapy department, Muhammad Abdullahi Wase Specialist hospital, Kano in December 2017. The patient reported a 3-year history of gradual onset of pain at the lower thoracic and lumbar regions. The patient's chief complaint was dull aching pain which was usually aggravated by prolonged sitting, standing, or walking. Resting in the form of side lying on either side was the only relieving factor reported. Pain severity was reported to be intermittent throughout the day. The patient had no radiating symptoms and reported no red flags, such as history of trauma, night pain, lower extremity neurological deficit, and bladder dysfunction. The patient had no history of medical and/or surgical conditions that could be related to his present complaint. Previous medications reported were analgesics (diclofenac), and muscle relaxants (chlorzoxazone) which provided only temporary relief of the pain.

This case study was approved by the Health research ethics committee, ministry of health Kano state. The patient provided signed informed consent and written permission for publication but without any photographs.

2.1. Physical Examination

On general observation, the patient had an ectomorphic body somatotype, weighed 50.0 kg and was 1.58 m in height (body mass index = 24.5 kg/m²). The patient walked into the examination room with a normal gait.

On local observation, postural analysis in standing position revealed lumbar hyperlordosis and thoracic hyperkyphosis (kypholordotic posture). The patient also presented with slight protruded chest, rounded shoulders, and anterior pelvic tilt.

On palpation, grade 1 tenderness (pain with touch) was elicited over the paraspinal muscles (erector spinae) in the thoracolumbar region. Spasm was also present in the same region.

Flexibility based on shortness was assessed for upper trapezius, pectoralis major, iliopsoas, rectus femoris, and hamstrings. Shortening of upper trapezius was tested with the patient in supine and the examiner passively flexed the patient's head and inclined to the contralateral side. The shoulder girdle was then pushed distally. The result was positive with difficult movement through the end range (6). Shortening of pectoralis major tightness was tested

with the patient in supine and trunk stabilized while the arm was moved passively into abduction reaching the horizontal level. The arm was allowed to hang down loosely and the examiner pushed the shoulder downward. The result was positive with hard soft tissue barrier (6).

Shortening of iliopsoas and rectus femoris was assessed using the modified Thomas test. For iliopsoas, the test was carried out with the patient in supine and the thighs positioned over the edge of the plinth. The patient was told to grasp the thigh of the untested limb and pull it toward the chest to flatten the back and stabilize the pelvis, preventing an increase in lumbar lordosis (7). The test result was positive with the hip remained flexed against gravity on a tested limb. Rectus femoris was tested by passive extension of the knee of the tested limb to neutralize the effect of the rectus femoris. The test was positive with no change in hip flexion (7). Hamstring shortening was tested using the active knee extension test. The test was carried out with the patient in supine and the tested leg flexed to 90° at hip and knee. The patient was instructed to grasp one knee of the tested leg with both hands to stabilize the hip (8). A universal goniometer was used to measure the angle of the knee range of motion. The patient was then asked to actively extend the tested knee as far as possible without any verbal encouragement until a mild stretch sensation was felt. The result was positive with the inability to achieve greater than 160° of knee extension (8).

Abdominal muscle endurance was assessed by the trunk flexion test (9). The test was carried out with the patient in sit-up position with trunk supported at 60° of trunk flexion. Knees and hips flexed at 90°, arms crossed over the chest, and feet secured. The support of the trunk was then removed and the patient held the position for as long as possible. The test was terminated when the participant was no longer able to hold the position (9).

Additionally, lumbopelvic instability was assessed by the prone instability test (10). The test was carried out with the patient lying prone on the plinth and legs over the edge and feet resting on the floor. The examiner applied posteriorly to anterior pressure to an individual spinous process of the lumbar spine. Then, the patient lifted the legs off the floor and posterior to anterior compression was applied again to the lumbar spine. The result was positive with provocation pain in the resting position but subsided in the second position (10).

2.2. Clinical Impression

Our clinical impression was a chronic mechanical back pain with impairment of posture (kypholordotic posture), pain, spine ranges of motion, and function.

2.3. Measurement of Outcomes

Spine alignment (LLC and TKC) in sagittal plane was measured using a flexible ruler as described by De Oliveira et al. (11). The flexible ruler method was shown to be reliable and valid for measuring both LLC and TKC (11). Pain intensity was assessed using a visual analogue scale (VAS; 0 - 100 mm) with higher scores indicating higher levels of pain intensity (12). The VAS has been shown to have good reliability and validity in assessing pain (12). Functional disability due to back pain was assessed using modified Oswestry disability index (MODI; 0% - 100%), with higher scores indicating higher levels of disability (12). The MODI was found to be reliable and valid in assessing disability in patients with LBP (12). Spine range of motion was assessed using the modified Schober's test (13). Active ranges of flexion and extension of the lumbar spine were measured as these were the only restricted motions and were limited by pain in the patient. The modified Schober's test was shown to be a reliable and responsive measure of the range of motion of the spine (13).

All outcomes were assessed before and after 8 weeks (16 sessions) treatment. The main patient's goal was to have a reduction in back pain. All data were entered manually into Microsoft Excel spreadsheet. Changes in outcomes were calculated by subtracting post-treatment scores from pre-treatment scores.

2.4. Interventions

2.4.1. Postural Education

Postural education (PE) was initially administered prior to exercise sessions. The program consisted of theoretical and practical sessions similar to the program described in a previous study (14). During the theoretical session, the patient was educated on basic anatomy, physiology, biomechanics of the spine, fundamentals of back pain, ergonomics, and postural hygiene (14). During the practical session, the patient was taught how to maintain optimal body posture with an emphasis on the neutral spine. Ergonomic guidelines relevant to back problems such as standing and sitting postures, bending, twisting, and lifting were emphasized. Also, the patient was advised to stay active as possible and avoid total bed rest.

2.4.2. Therapeutic Massage

Therapeutic massage (TM) was applied to the entire back (from sacrum to occipital) while the patient was lying comfortably in supine position. Five techniques were used including effleurage (gliding strokes), petrissage (kneading, wringing, rolling), tapotement (tapping), friction, vibration, and traction. A topical greaseless ointment (NeuroGestic extra) was used as the massage medium. The techniques were applied twice a week for 8 weeks. The goals

were to relieve pain and increase structural balance and function by inducing a generalized sense of relaxation.

2.4.3. Segmental Stretching Exercises

The patient received structured segmental stretching exercises (SSE) aiming at improving flexibility by toning the postural muscles (pectoralis, upper trapezius, erector spinae, quadratus lumborum, iliopsoas, rectus femoris, short and long hip adductors, hamstrings, and triceps surae) around the upper and lower back and pelvis. While performing each exercise, normal breathing pattern was emphasized with no compensation by fixing the nearby segments. The manner of exercise progression was based on the intensity designed according to the treatment sessions, with the 1st to 4th sessions containing minimal intensity (15 seconds holds, 5 repetitions), 5th to 10th sessions containing moderate intensity (20 seconds holds, 7 repetitions), and 11th to 16th sessions containing higher intensity (30 seconds hold, 10 repetitions).

2.4.4. Motor Control Exercises

Motor Control Exercises (MCE) aiming at improving the function of specific muscles of the lumbopelvic region and the control of posture and movement were implemented in three phases. The program was largely based on the program described by Rabin et al. (15) with a few minor changes in the order and dosage of the exercises. The first phase (1st to 4th sessions) began with low-load activation of the local stabilizing muscles (lumbar multifidus, transversus abdominis) isometrically. In the second phase (5th to 12th sessions), additional loads were placed on the spine through various upper and lower extremities and trunk movement patterns with the goal of recruiting a variety of trunk muscles (15). In the final phase (13th to 16th sessions), functional movement patterns were incorporated into the training program. For each exercise, 7 seconds contraction was held and repeated for 10 times. Progression and intensity of all exercises were based on the patient's fatigue, pain thresholds, or observed movement control.

All exercises (i.e. SSE and MCE) were performed twice per week under supervision for 8 weeks. The patient was encouraged to perform the exercises at home on daily basis.

3. Results

After 8 weeks of treatment, LLC reduced from 83.8° to 76.3°, TKC from 65.2° to 60.6°, back pain from 7cm to 1cm, and functional disability from 46.7% to 20.0% while flexion and extension ranges of motions increased from 5.2cm to

7.5 cm and 3.5 cm to 4.7 cm, respectively (Table 1). The patient reported no longer consumption of any pain medication and was able to perform his usual activities of daily living. Overall, the patient reported a great satisfaction with the treatment.

Table 1. Effects of Treatment on the Examined Variables

Variables	Pre-Rx	Post-Rx (8-w)	D
LLC, degrees	83.8	76.3	7.5
TKC, degrees	65.2	60.6	4.6
VAS, mm	7.0	1.0	6.0
MODI, %	46.7	20.0	26.7
Flexion range of motion, cm	5.2	7.5	2.3
Extension range of motion, cm	3.5	4.7	1.2

Abbreviations: D, Difference; LLC, lumbar lordotic curve; MODI, modified Oswestry disability index; Rx, treatment; TKC, thoracic kyphotic curve; VAS: visual analogue scale.

4. Discussion

The outcome of this case study indicates that the combination of PE, TM, SSE, and MCE was effective in improving the sagittal spine malalignment, back pain, spine ranges of movement, and functional disability in this patient.

Postural alteration due to muscle imbalance plays an important role in the development of chronic back syndromes (16). It is assumed that decreased flexibility in the thoracolumbar extensors, iliopsoas, rectus femoris, and hamstrings combined with the decreased strength of the abdominal muscles leads to compensatory hyperlordosis and anterior tilting of the pelvis. These postural alterations and the associated muscular imbalance are believed to cause extra mechanical stress to the joint and soft tissue of the lumbar, resulting in pain and functional impairment (17).

Prior to treatment, the patient LLC and TKC were 83.8⁰ and 65.2⁰, respectively. These values are higher than the reported normal range values in adult, which are around 31⁰ to 79⁰ and 20⁰ to 50⁰ for LLC and TKC, respectively (3), indicating the patient had kypholordotic posture. The increase in LLC might be the reason for the increased TKC due to the ongoing compensatory mechanism of the spinal musculature to cope with the increased LLC. Considering the age of the patient and when the problem started, his postural problem could be explained by the fact that many postural alterations originate in childhood and adolescence which they might be partially due to many intrinsic factors such as age and extrinsic factors such as physical activity (17).

Our intervention resulted in a significant reduction in both LLC and TKC, especially LLC (83.8⁰ to 76.3⁰) after 8

weeks of treatment. These effects might be attributable to the fact that the application of the SSE helps to normalize shortening of muscles responsible for abnormal alignment in this region, hence better posture. In addition, MCE is believed to aid in the recovery of the spinal alignment by enhancing strength and coordination of the trunk muscles.

The results of the current study also revealed a significant improvement in back pain, spine ranges of motion, and functional disability. SSE has been shown to reduce pain and functional disability in patients with chronic low back pain (18). The stretching implemented in this study is believed to have an effect on pain by improving blood circulation and sufficient oxygen supply to the muscle cells, which help to reduce metabolites and alleviate pain. Similarly, MCE has been shown to be effective at improving pain and functional disability in sufferers from chronic low back pain (19). This exercise may reduce episodes of back pain by enhancing trunk stabilization through the activation of the deep trunk muscles, which minimizes the compressive forces on spinal structures. The decrease in pain and increase in the range of motion were thought to help the recovery of normal movements and improvement of the function.

By contrast, PE has been advocated for the prevention and treatment of postural pain through adopting healthy postural habits. Though the effect of isolated PE has not been well established on spine alignment, the implementation of PE has been shown to enhance self-reported postural behavior (healthy postural habits) and minimize pain episodes (14). The addition of PE in this study is assumed to reduce the impact of faulty posture on the symptoms and its aggravation by promoting correct postural attitude.

Additionally, it could be hypothesized that the TM implemented in this study contributed in reducing the patient's pain by increasing blood flow, which leads to increased clearance of local pain mediators, and improving function by inducing a generalized sense of relaxation. In line with the current study, the results of previous trials (20, 21) indicate that massage is effective in reducing pain and functional disability, as well as improving mobility and psychological well-being, in chronic low back pain, especially if accompanied with exercises (20).

Our study is limited for being a single case study and thus the results cannot be generalized. Given that the nature of our intervention is multimodal, it would be difficult to isolate the efficacy of each of the treatment techniques used. In addition, it seems there is a dearth of studies in the form of either case studies or randomized controlled trials on the combined effects of PE, TM, SSE, and MCE, thus making cross comparisons difficult with other

studies.

In conclusion, our multimodal treatment program resulted in a significant improvement in the patient symptoms. Overall, the patient was happy and satisfied with the treatment. The findings of this study might influence the choice of assessment and treatment techniques in the management of chronic back pain associated with kypholordotic posture. In a future large study using a blinded, randomized, controlled design, we intend to investigate the short and long-term effects of either one or combination of the interventions in the management of the similar condition.

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