

‘Ergonomics Adjustments For Chronic Mechanical Low Back Pain Patient’: A Case Study

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Abstract

Background: Ergonomics aims to optimize work environments to align with individual physical capabilities, particularly in healthcare settings where chronic low back pain is prevalent among professionals like dentists. This study investigates the effects of ergonomic adjustments combined with conventional physiotherapy on a 30-year-old female dentist suffering from chronic low back pain.

Method: The patient underwent an initial treatment phase focusing on stretching and strengthening exercises, followed by a three-week period of ergonomic interventions targeting her workplace environment. Pain intensity, functional status, and quality of life were assessed using the Numerical Pain Rating Scale, Oswestry Disability Index, and WHOQOL-BREF questionnaire.

Results: After four weeks, the patient's pain intensity decreased from 7/10 to 3/10, and her functional status improved from 44% (severe disability) to 16% (mild disability). Significant enhancements in physical health and environmental perceptions were noted, with WHOQOL-BREF scores indicating improved overall well-being.

Conclusion: The integration of ergonomic adjustments with physiotherapy significantly alleviated pain and improved functional capacity and quality of life for the patient, highlighting the importance of ergonomic principles in managing chronic low back pain in physically demanding professions.

Keywords: Chronic low back pain, physiotherapy, ergonomics, dentists, Numerical Pain Rating Scale, Oswestry Disability Index, WHOQOL-BREF, pain relief, functional performance.

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I. Introduction

Ergonomics is the study dedicated to optimizing workspaces, tools, tasks, and equipment to align with the physical abilities and limitations of individuals. Its goal is to foster a safer and more comfortable environment, minimizing the risk of work-related injuries^[1]. This discipline holds particular significance in healthcare, where the physical strain on workers often contributes to chronic mechanical low back pain and other musculoskeletal conditions. Chronic low back pain is a widespread issue affecting a significant number of adults, particularly in professions that demand prolonged poor posture and repetitive physical strain^[2]. Studies highlight that the work routines of healthcare professionals, including dentists, are often highly strenuous and physically taxing. Dentists are particularly susceptible due to their work environment^[3], which often involves extended static postures, uncomfortable positions, and sustained bending. These ergonomic challenges can lead to chronic pain disorders, spinal tension, and muscle imbalances^[4]. This case study examines the condition of a 30-year-old female dentist suffering from chronic low back pain, with an emphasis on assessing the impact of integrating ergonomic adjustments with conventional physiotherapy. Initially, the patient underwent a treatment phase that focused exclusively on stretching and strengthening exercises. This phase was designed to establish a baseline for evaluating her response to therapy and to improve core stability and muscular strength^[5]. Following this, ergonomic interventions were introduced over a subsequent three-week period. These modifications targeted her workplace environment and daily activities, aiming to address the physical demands of her profession and minimize strain on the lower back. The study's primary goal was to assess not only the degree of pain relief achieved but also the improvements in functional capacity. By enhancing her ability to carry out daily tasks without aggravating her symptoms, the approach sought to promote long-term management and prevention of recurrence. This comprehensive evaluation highlights the potential benefits of combining ergonomic strategies with physiotherapy techniques in addressing chronic low back pain, particularly in physically demanding professions such as dentistry^[6].

II. Case Study:

History: we describe a 30 year old female patient who is a dentist by profession. Her height is 162 cm and she weighs 55kg and has a BMI of 20.9. The patient complained of low back pain that got aggravated during prolonged standing, forward bending, lifting heavy instruments or equipment, and extended periods of sitting. The pain is relieved by rest, pain killers and occasionally using a hot pack at night. Over the last two months, it has increased in frequency and intensity, now persisting daily. She has no history of trauma.

Physical Examination: The patient's lumbar spine movements were restricted and had a MMT of 3 for the lumbar muscle groups. The patient also had forward head posture with rounded shoulders and mild lumbar paraspinal tightness.



Figure 1: shows the assessing of patient's spinal mobility and posture. This helps identify restrictions, muscle imbalances, or pain patterns that can guide ergonomic recommendations. This guidance helps the patient understand their own posture, particularly lumbar alignment, which is critical for maintaining proper posture during work or daily activities.



Figure 2. The patient is taught to keep the feet are flat on the ground, as it promotes even weight distribution and avoids unnecessary stress on the knees and hips. Proper leg positioning is essential for maintaining spinal alignment.

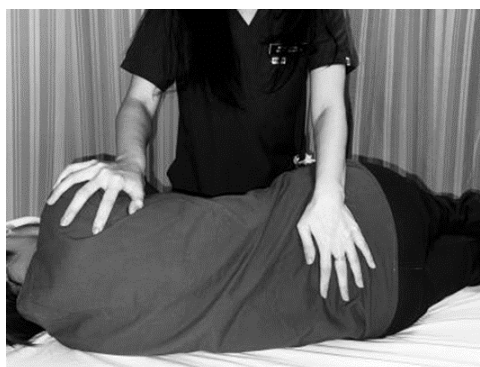


Figure 3 shows therapist performing Joint Mobilization which helps improve the mobility of the lumbar spine, reducing stiffness caused by prolonged static postures.

Procedure

Informed consent was taken from the patient in written form. The detailed assessment of the patient was done including the patient's demographic data, physical examination which included both motor and

sensory examination. The patient's pain, low back disability and quality of life were checked using the numerical pain rating scale, owestry disability index^[7] and WHO Quality of life bref questionnaire^[8] twice, first time during the first week of treatment and second time after fourth week of treatment.

Treatment given

Week 1

1. Heat Therapy: Warm pack on lumbar region for 10-15 minutes.
2. Stretching and ROM Exercises: A. Pelvic Tilts: 10-15 reps. B. Cat-Camel Stretch: 10 reps. C. Knee-to-Chest Stretch: 10-15 seconds hold, 2-3 reps per leg.
3. Core Activation: Transverse Abdominis Activation 10 reps.
4. Core Stabilization: Bridging: 10-15 reps.
5. Flexibility - Hamstring Stretch: 15-20 seconds hold, 2-3 reps per leg. - Hip Flexor Stretch: 15-20 seconds hold, 2-3 reps per leg. Pififormis muscle stretch
6. Electrotherapy: Interferential current therapy for 10 minutes.

Weeks 2-4:

1. Continued with Week 1 Treatments

The treatment plan, which included heat therapy, stretching exercises (such as pelvic tilts, cat-camel stretches, and knee-to-chest stretches), core activation and stabilization exercises, flexibility routines (targeting the hamstrings, hip flexors, and piriformis muscles), and 10-minute sessions of interferential current therapy, was consistently repeated to help alleviate pain and improve spinal function.

2. Ergonomic Adjustments implemented

Category	Intervention	Key Details
Workstation Adjustments	Dental Chair and Patient Positioning	- Use an adjustable chair with lumbar support and a saddle seat to maintain a neutral spine.
		- Position the dental chair so the patient's mouth aligns with the dentist's elbow level to reduce neck flexion and forward bending.
	Tool and Instrument Placement	- Arrange frequently used tools within easy reach to minimize twisting, bending, or overreaching.
	Lighting	- Optimize overhead lighting and consider using a headlamp for better visibility and neck alignment.
Posture Training and Awareness	Neutral Spine Posture	- Maintain slight lumbar lordosis and avoid slouching.
		- Keep shoulders relaxed and aligned with the pelvis.
	Dynamic Posture	- Change postures frequently to prevent prolonged static loading.
Workstation Ergonomic Devices	Foot Rest	- Provide a footrest to facilitate weight shifting during long periods of sitting.
	Armrests or Forearm Supports	- Use supports to stabilize posture and reduce upper limb strain.
Schedule Adjustments and Breaks	Micro-Breaks	- Implement breaks every 20-30 minutes for stretching or postural exercises.
		- Incorporate simple movements such as walking or stretches during breaks.

Patient Outcomes

1. **Pain Intensity:** Decreased from 7/10 (before ergonomic adjustments) to 3/10 (after 4 weeks).
2. **Functional Status** (ODI: Improved from 44% (severe disability) to 16% (mild disability) This suggests that the patient can perform her work and daily tasks with less discomfort and limitation.
3. **Motor functions improvements**

Lumbar Spine:

Movement	Normal ROM	Pre treatment	Post treatment
Flexion	0-60 degrees	0-30 degrees	0-50 degrees
Extension	0-25 degrees	0-10 degrees	0-20 degrees
Lateral Flexion (Right)	0-25 degrees	0-15 degrees	0-20 degrees
Lateral Flexion (Left)	0-25 degrees	0-15 degrees	0-20 degrees
Rotation (Right)	0-30 degrees	0-15 degrees	0-25 degrees
Rotation (Left)	0-30 degrees	0-15 degrees	0-25 degrees

Manual Muscle Testing (MMT)

Muscle Group	After 1 Week	After 4 Weeks
Lumbar Flexors (Rectus Abdominis, Iliopsoas)	3/5 (Fair)	4/5 (Good)
Lumbar Extensors (Erector Spinae)	3/5 (Fair)	4/5 (Good)
Right Lateral Flexors (Quadratus Lumborum, External Oblique)	3/5 (Fair)	4/5 (Good)
Left Lateral Flexors (Quadratus Lumborum, External Oblique)	3/5 (Fair)	4/5 (Good)
Right Rotators (External and Internal Obliques)	3/5 (Fair)	4-/5 (Good minus)

- 4. **Pain Recurrence:** Noticeably reduced during weeks 2-4 with ergonomic adjustments.
- 5. **Functional Endurance:** Improved ability to maintain postures without discomfort.
- 6. **Postural Awareness:** Increased awareness of ergonomic positioning and better self-correction.
- 7. **Quality of Life (WHOQOL-BREF):**

	Before Ergonomic Adjustments	After 4 Weeks of Ergonomic Adjustments
Physical Health	25	64.25
Psychological	33.125	37.5
Social Relationships	58.125	58.125
Environment	53.125	78.125

- a) Physical Health: Improved from 25 to 64.25. b) Psychological c) Increased from 33.125 to 37.5. d) Environment: Improved from 53.125 to 78.125.

III. Discussion

A randomized controlled trial along with other more researches done shows that ergonomic workstation adjustments significantly reduce musculoskeletal pain, particularly in the neck, shoulders, upper back, and wrists/hands^[9,10,11]. The experimental group, which received ergonomic interventions, experienced notable pain relief compared to the control group^[12]. These results highlight the importance of ergonomic guidelines to prevent discomfort from prolonged poor posture, improve worker productivity. Studies show that effective ergonomics can greatly improve the health and efficiency of healthcare professionals. For example, research in Iran revealed that nurses had a moderate level of awareness regarding ergonomic principles^[13]. It also demonstrated that greater knowledge of these principles was associated with a reduction in work-related injuries. This highlights the importance of educating healthcare workers on ergonomic practices, enabling them to better adapt their work environments and reduce the risk of chronic conditions, such as lower back pain^[14]. This case study done illustrates the significant impact of ergonomic adjustments on a 30-year-old female dentist suffering from chronic mechanical low back pain. Initially, the patient experienced persistent discomfort that was exacerbated by her occupational demands, leading to a notable decline in her functional status and quality of life. The treatment plan, which began with conservative measures such as heat therapy and stretching, laid the groundwork for subsequent ergonomic interventions. The incorporation of ergonomic adjustments over the following weeks resulted in a marked reduction in pain intensity, as evidenced by a decrease in the Numerical Pain Rating Scale from 7/10 to 3/10, and an improvement in the Modified Oswestry Disability Index from 44% (severe disability) to 16% (mild disability). Additionally, the WHOQOL-BREF assessment revealed substantial enhancements in physical health and environmental perceptions, indicating that the patient experienced not only pain relief but also improved overall well-being. These findings underscore the importance of integrating ergonomic principles into treatment plans for individuals in occupations with high physical demands, highlighting the potential for improved outcomes in pain management and quality of life^[15,16].

IV. Conclusion

In conclusion, incorporating ergonomic adjustments along with conventional physiotherapy is effective in significantly reducing pain, improving functional status, improving motor functions and enhancing quality of life in chronic low back pain management for high risk professionals.

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