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Effectiveness of Prefabricated Lumbar Sacral Orthosis (LSO) Corset for Pain Relief in Low Back Pain (LBP) Health Students

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Abstract

Background: Low back pain (LBP) is a common musculoskeletal disorder often caused by poor ergonomics. Students are particularly vulnerable due to prolonged static positions and awkward postures, leading to decreased concentration, reduced attendance, and diminished productivity. LBP can also affect engagement in social activities, ultimately lowering quality of life. Addressing ergonomic factors is crucial for improving health outcomes and academic success.
Objective: This study aims to evaluate the effectiveness of a prefabricated lumbar sacral orthosis (LSO) corset in reducing pain intensity and improving functional activity levels among students with LBP in the Dental Health and Prosthetics Orthotics Departments at Poltekkes Kemenkes Jakarta I.
Method: A quantitative, pre-experimental one-group pre-test post-test design was employed, involving 30 students from Jakarta Polytechnic I.
Results: Among the participants, 26 students (86.7%) experienced a significant reduction in pain levels, while 4 (13.3%) continued to report moderate pain. Statistical analysis yielded a p-value of <0.01, indicating significant pain reduction. The effect size, calculated using Cohen's d, was 1.34, demonstrating a large effect and suggesting a meaningful impact of the intervention.
Conclusion: The prefabricated LSO corset significantly reduced pain levels and improved functional activity among affected students.
Suggestions: Future studies should involve a larger participant pool, improved research monitoring, and comparisons between corsets with and without support bars for more robust findings.

Keywords: Low back pain, Pain sensation, Oswestry Disability Index, LSO corset, Ergonomics.

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Introduction

Low back pain is a musculoskeletal disorder due to incorrect ergonomics. Low back pain can occur in children to adults (Rahmawati, n.d.) Dental health students are considered to be one of the ones who can get low back pain due to frequent static positions and awkward postures (Vijay & Ide, 2016). Changes in the shape of the spine, age, muscle weakness, body position when doing practice, repetitive movements, lifting techniques and mechanical pressure are factors that cause back pain, the long-term effect is the lengthening of muscles and joints, especially in the neck, back and shoulders so that it causes symptoms such as low back pain (Rahyussalim, A. J., et al., 2020)

The work factor during the practicum is also associated with the occurrence of Low Back Pain. It is known that when doing the practicum, Dental Health students are in a standing or sitting position, and the patient is in a lying position on a dental chair. This makes Dental Health students have to turn their heads and bend over to do practicum and it takes a long time and more concentration when doing practicum. In dental health students, ergonomics needs to be considered because of the risk of getting health problems such as musculoskeletal disorders due to unergonomic work positions or practices.

As a student, they are very busy with theoretical and practical lectures, in carrying out practicum activities such as rectification, which is the process of modifying tools from the results of printing negative casts, in carrying out these activities it really takes more time and energy because the tools used are very unergonomic so that they cause a lack of attention to the correct posture when carrying out practicum activities. Repeated activities carried out by students every day will result in fatigue and pain in the lower back due to doing practicum. Most cases of Low Back Pain often occur due to overwork, excessive muscle use, sitting positions for too long, lifting heavy weights carried out by students in the learning process so that it can be the cause of Low Back Pain stated that the pressure on the spine will increase when sitting if lumbar lordosis disappears, then isometric contractions occur in the main muscles and make the muscles of the lower back area work as the main weight bearer (Ayed, H. B., et al., 2019). When the lower back muscles work as a weight support, it causes excessive contractions so that pain is experienced in the area.

This proves the importance of knowing the correct posture when doing practicum to reduce low back pain. According to another study, the prevalence of Low Back Pain in students majoring in Orthotics and Prosthetics at the Surakarta Health Polytechnic has several individual risk factors consisting of gender, body mass index and exercise habits (Wulandari, M., et al., 2017). The factors that increase the risk of Low Back Pain the most are due to exercise habits, length of standing, weightlifting habits and stress levels.

Based on observations in the field, one of the activities of students of the Prosthetic Orthotics study program is casting, rectification on negative models, as well as fabrication on positive models, and assembling components in designing orthopedic prostheses, these activities are the intensity of standing for too long, manual handling in the wrong position can trigger low back pain. Lower back pain is most commonly found due to movement or posture abnormalities that last for a long period of time. Low back pain is related to stress and strain of back muscles due to excessive activities such as sitting, standing for too long and lifting heavy objects in the wrong position. According to (Manchikanti, L., et al., 2019) in industrialized countries such as Indonesia, low back pain mostly affects workers with a productive age of 20-40 years.

Methods

The research conducted is a quantitative study employing a pre-experimental method. Specifically, a one-group pre-test post-test design was chosen to evaluate the impact of a prefabricated lumbar sacral orthosis (LSO) on students with low back pain (LBP). This design allows for the assessment of changes in pain intensity and functional activity levels within the same group of participants before and after the intervention.

The rationale for selecting this design is its focus on individual change. The one-group pre-test post-test design enables the examination of individual changes in pain and function within the same group, making it easier to attribute any observed effects directly to the intervention.

This design is practical for studies with limited resources or smaller participant pools, as it requires only one group of subjects, reducing the complexity and time associated with recruiting and managing multiple groups.

As an exploratory study, this design provides preliminary data on the effectiveness of the LSO intervention, which can inform future research and larger, more rigorous trials.

The selection of subjects in this experimental research was conducted using a purposive sampling method. This approach allows researchers to select participants based on specific characteristics that align with the objectives of the study. In this case, participants were chosen based on their diagnosis of low back pain (LBP) and their enrollment in the Dental Health and Prosthetics Orthotics Departments at Poltekkes Kemenkes Jakarta I.

Specific Characteristics Used for Selection:

1. Participants must have a clinical diagnosis of LBP, ensuring that the study focuses on individuals who will benefit from the lumbar sacral orthosis (LSO) intervention.
2. Participants were required to be students in the relevant departments, as the study aimed to assess the impact of LSO on a population with specific academic and ergonomic challenges.
3. Inclusion criteria may specify an age range (e.g., 18-30 years) to ensure that the participants are within a developmental stage relevant to the study's focus on academic performance and ergonomics.

These characteristics were determined to be relevant based on existing literature indicating that students often experience higher rates of LBP due to prolonged sitting and poor posture while studying. By focusing on this demographic, the study aims to address a common issue faced by students in academic settings.

Inclusion Criteria:

1. Participants must be students enrolled in the Dental Health and Prosthetics Orthotics Departments at Poltekkes Kemenkes Jakarta I.
2. Participants must have a clinical diagnosis of low back pain (LBP).
3. Participants must provide informed consent to participate in the study.

Exclusion Criteria:

1. Individuals with a history of spinal surgery or major trauma.
2. Participants with contraindications to using a lumbar sacral orthosis (LSO), such as skin conditions that may be aggravated by wearing the device.
3. Individuals who are currently undergoing other forms of treatment for LBP could confound the study results.

Results

Based on the table above, the characteristics of participants by gender in this study amounted to 30 people consisting of 4 men (13.3%) and 26 women (86.7%).

Table 1. Participant Characteristics by Gender and Age (n = 30)

Gender	*Frequency*	*Percent (%)*
Man	4	13,3
Woman	26	86,7
Adolescence	2	6.7
Adulthood	28	93.3
Total	30	100

Table 2. Participant characteristics based on pain level before and after the intervention

Pain	*Before Using Corset LSO Device* *Frequency*	*After Using Corset LSO Device* *Frequency*
No pain	0	19
Mild	13	11
Moderate	17	-
Total	30	30

Based on table 2 above, the characteristics of participants based on the level of pain before the intervention consisted

of 13 people with mild pain and 17 people with moderate pain while the characteristics of participants based on the level of pain after the intervention consisted of 19 people with no pain and 11 people with mild pain.

Table 3. Participant characteristics based on function level before and after the intervention

Function level	*Before Using Corset LSO Device*	*After Using Corset LSO Device*
	Frequency	*Frequency*
minimal	22	30
moderate	8	0
Total	30	30

Based on table 3 above, the characteristics of participants based on the level of function before the intervention using the girdle consisted of 22 people with a light level of function (73.3%), 8 people with a moderate level of function (26.7%), while the characteristics of participants based on the level of function after the intervention using a corset consisted of 30 people with a minimum level of function (96.7%).

Table 4. Analysis of Function Level Test Results for Lower Back Pain

Pain	*Before Using Corset LSO*	*After Using Corset LSO*
Pain minimum	22	29
Moderate pain	8	1
P value	0.000	
Mean±SD	1.27±1.17 reviews	1.03 ± 0.03

Based on the results of the Wilcoxon Signed Rank Test in the p value table of 0.000 which is less than the critical limit of 0.05 This shows that there is a decrease in the degree of pain before and after using the LSO bodice prefabrication.

Table 5. Analysis of Test Results on the Level of Back Pain

Disability	*Before Using Corset LSO*	*After Using Corset LSO*
Mild pain	8	29
Moderate pain	22	1
P value	0.00	
Mean±SD	1.73±450	Jan. 03±183

Based on the results of the Wilcoxon Signed Rank Test in the table p value of 0.00 where the critical limit of the study is 0.05 This shows that there is a significant effect of decreasing the degree of pain between the degree of pain before and after using the prefabricated corset.

Discussion

The findings of this study demonstrate that the use of a prefabricated Lumbosacral Orthosis (LSO) corset has a significant impact on reducing pain levels and improving functional abilities in individuals with low back pain. Among the 30 participants, there was a clear reduction in pain intensity post-intervention, which aligns with the established notion that external support provided by devices like the LSO corset alleviates mechanical stress on musculoskeletal structures. By stabilizing the lower spine and limiting excessive movement, the LSO corset reduces strain on muscles, ligaments, and joints, resulting in decreased pain in the lower back and other affected areas, such as the neck and shoulders (Solberg, J., et al., 2021).

In addition to pain reduction, this study observed a meaningful improvement in disability levels associated with low back pain. The participants reported a notable decrease in limitations for daily activities after using the LSO corset. Specifically, the disability score decreased by 1.18 points post-intervention compared to pre-intervention levels, highlighting the effectiveness of the LSO corset in restoring functional capacity for those with

low back pain. This reduction in disability underscores the importance of stabilizing the lower back to minimize pain and support daily activities that require movement and strength.

These results contribute to the growing body of evidence supporting the use of LSO corsets in pain management and disability reduction for individuals with chronic low back pain. However, while the short-term benefits are evident, further studies with extended intervention periods would provide insights into the long-term efficacy and potential adaptability of the musculoskeletal system to LSO support over time. Future research could also explore variations in LSO design and material composition to optimize comfort, durability, and overall effectiveness for users with diverse needs.

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