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Effect of Structural Physiotherapy Protocol on Pain and Radiological Changes by Computerized Vision in Sacralization: A Case Report

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ABSTRACT

A congenital disorder known as sacralization occurs when the fifth lumbar vertebra (L5) partially or totally fuses to the sacrum. Some cases might be asymptomatic but common indicators include stiffness, reduced mobility, and lower back pain. Purpose of this study is to evaluate the effect of structural physiotherapy protocol on pain and radiological changes by computerized vision in sacralization. The impact of a structured physiotherapy protocol was assessed using a single-subject case report design in a patient with sacralization of the lumbar vertebra. Ethical approval was obtained from both the institution and the parents. The intervention was carried out over a period of three months after a clinical examination and baseline radiological imaging. The Numerical Pain Rating Scale (NPRS) was used to measure the intensity of the patient's pain, and lumbar motion was evaluated through a combination of movement tests measured before and after the intervention using a validated computerized vision system. Post intervention assessment revealed a significant reduction in pain, with NPRS decreased. Radiologically, there was an observable increase in lumbar lordosis and improved intervertebral spacing. The lumbosacral angle improved markedly from 49.7° to 30.2°, nearing the normative range ($p<0.0001$). Functional testing demonstrated improved lumbar flexion and extension. The structured physiotherapy protocol was effective in reducing pain and inducing radiological and functional changes in a patient with sacralization. This case highlights the potential role of individualized manual and exercise-based interventions in managing biomechanical alterations due to sacralization.

1. INTRODUCTION

The costal aspect of the L5 transverse process articulates or merges with the sacrum in sacralization, an anomaly of the lumbosacral spine. Lower back pain (LBP) can happen from overuse and excessive strain on the L4–L5 intervertebral disc, which occurs when the L4 becomes the final fully functional lumbar vertebra because of this fusion. Additionally, this disease may result in overactivity in the quadratus lumborum muscle and a reduction in the L5–S1 intervertebral gap[1].

Sacralization is one anatomical abnormality that contributes to low back pain, that is linked to several aetiologies. This study used a management strategy that was mostly based on manual therapy [2]. Even though there are numerous therapeutic options available, taken into consideration like Pilates-based exercises, manual and mechanical lumbar traction, and sacral mobilization were among the therapies that demonstrated encouraging results [3].

Fusion of the fifth lumbar vertebra with the sacrum is also known as sacralization, which is another anatomical variation [4]. On a clinical basis, this condition has a lineage with low back pain and associated symptoms that radiate to the lower limb, which may suggest both nerve involvement and mechanical strain [5].

A 21-year-old female patient presented with a clinical history of low back pain following a minor trauma sustained in a bus accident approximately one week prior. The patient reported slipping and landing on the floor but did not experience immediate pain at the time of the incident. After some days, she began to experience severe pain,

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initially aggravated by prolonged sitting. She attempted to manage the discomfort using hot packs, which provided only temporary relief. Over the following days, the pain intensified and extended to periods of prolonged standing as well.

On physiotherapy assessment, it revealed that patient is experiencing severe low back pain, restricted lumbar range of motion, and discomfort during spinal movements. Pretreatment radiological findings revealed sacralization of the L5 vertebra, an increased lumbosacral angle, and reduced intervertebral disc space.

Further evaluation using Janda's movement pattern assessment indicated a positive trunk curl-up component, reflecting functional deficits in trunk stabilization. Segmental mobility testing of the lumbar vertebrae was performed manually, yielding the following findings:

- L1 – Grade 3: Normal mobility
- L2 – Grade 2: Mild hypomobility
- L3 – Grade 2: Mild hypomobility
- L4 – Grade 1: Marked hypomobility
- L5 – Grade 1: Marked hypomobility

Notably, the lumbar lordotic curvature was preserved. The lumbosacral angle was quantitatively assessed using a computer-based application validated for clinical accuracy and consistency.

For managing pain and improving mobility in individuals with sacralization, combining the physiotherapy approaches of soft tissue mobilization and joint mobilization works [6]. Sacralization influences the recovery period, which will be there after spinal surgeries [7]. This instance is unique in that the lumbosacral angle, which was the main measure of progress, was evaluated using computer vision. A more focused and impartial study was made possible by this new computerized method. Radiographs taken before and after therapy showed notable improvements, confirming the implemented intervention's favourable prognosis.

At the L4-L5 level, when sacralization occurs at L5, the vertebra becomes more unstable, which may lead to slippage of vertebrae [8]. Due to persistent, unexplained low back pain, individuals may have chances to develop transitional vertebral sacralization. And this is the main indicator of showing linkage between sacralization and low back pain [9]. Even though there will be no specific changes seen on X-RAY, an individual may fall at risk of mechanical low back pai [10]

2. MATERIALS AND METHODS

2.1. Participants and Research process

A 21-year-old female presenting with chronic low back pain (>6 months), discomfort, and restriction during lumbar movements, along with radiological changes indicative of sacralization. Investigations were done, and initial X-ray findings, conducted before starting the regimen, revealed sacralization, an increased lumbosacral angle, and reduced intervertebral space. Post X-ray was also done and showed significant improvement.
After completing months of structured program X-ray was done and the outcome measures assessed.

2.2. Data collection techniques

Initial assessments highlighted the patient's limited lumbar mobility and postural instability, necessitating a structured physiotherapy regimen aimed at improving spinal alignment and reducing discomfort. The treatment protocol was delivered in three progressive phases over a 12-week period which is detailed showed in table 1.

Table 1. Therapeutic intervention

Weeks	Exercises	Repetitons
0–4 weeks	- Pilates-based breathing exercises - Sacral mobilization - Manual lumbar traction	5 Repetitions, 3 sets
4–8 weeks	- Pilates breathing with neck rotations - Side-lying thoracic rotations - Supine neck mobility exercises - Static back strengthening - Mechanical lumbar traction - Sacral mobilization	10 Repetitions, 3 sets
8–12 weeks	- Side-lying clamshell exercises - Tabletop position (Pilates) - Reinforcement of previous exercises - Mechanical lumbar traction - Sacral mobilization	10 repetitions, 5 sets

3. RESULTS

3.1. Clinical changes:

The Numeric Rating Scale (NRS) is a widely utilized tool for the assessment of pain intensity. It is designed to measure a patient's perceived pain severity at a specific point in time using an 11-point scale, where 0 represents "no pain" and 10 indicates "the worst pain imaginable."

INTERPRETATION: 1-3 is mild pain. 4-7 is moderate pain and 8-10 is severe pain.

Figure.1. a. Pre-treatment NPRS

In pre-treatment NPRS, according to figure 1.a. the pain intensity was about 8.

Figure. 1. b. Post-treatment NPRS

Based on figure 1.b., post treatment NPRS, the pain intensity decreased up to 2.

3.2. Radiological changes:

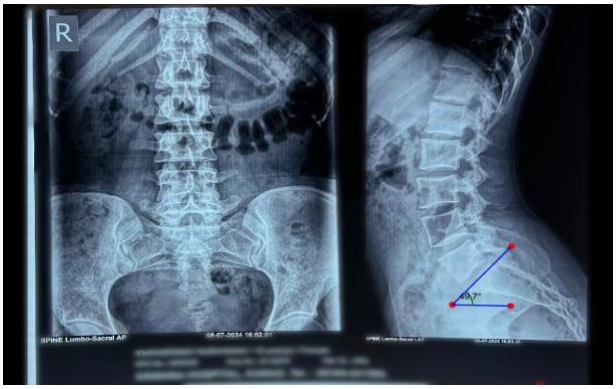

Figure 2.a. Pre-treatment X-ray (08-07-2024)

Findings on the basis of figure 2.b.:

1. It represented noticeable lumbar lordosis.
2. Lumbosacral angle has been measured which is 49.7° in pre-x-ray.
3. Sacralization is seen.

Physiotherapy Intervention and Post-Intervention Outcomes:

Based on the clinical assessment and radiological findings, a structured physiotherapy protocol was devised. The intervention incorporated manual lumbar traction, segmental mobilization techniques, and Pilates-based therapeutic exercises. The regimen was systematically administered over a period of three months.

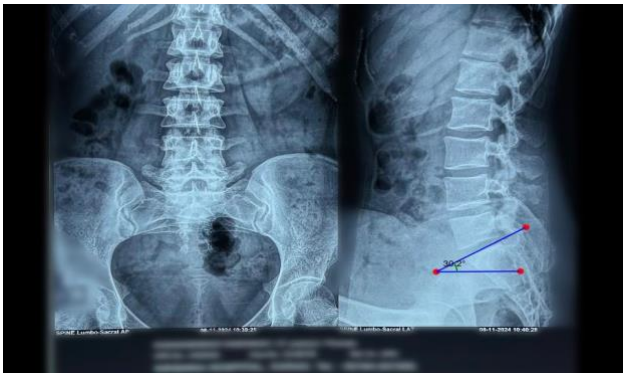

Figure 2.b. Post-treatment X-ray (08-11-2024)

The results of the intervention as per figure 2.b. are summarized as follows:

1. Lumbar Lordosis: An observable increase in lumbar lordotic curvature was noted, accompanied by improved intervertebral spacing.
2. Lumbosacral Angle: Pre-treatment measurement indicated a lumbosacral angle of 49.7°, which improved to 30.2° post-intervention, approaching normative values. Measurements were obtained using a validated computer-based application.
3. Combined Movement Patterns: Enhanced movement patterns were demonstrated through improved lumbar flexion and extension capabilities.

4. DISCUSSION

The current study has been conducted on a 21-year-old female with the major complaint of low back pain that gets aggravated during prolonged sitting. She was diagnosed with sacralization radiologically with a hyper lordotic lumbar curve. Sacralization, a congenital anomaly characterized by the fusion of the fifth lumbar vertebra with the sacrum, often leads to biomechanical alterations and symptoms like low back pain (Konin et al., 2010) [11]. Similar studies have emphasized the

importance of targeted interventions, including traction and mobilization, in improving spinal biomechanics and reducing symptoms in sacralization cases [12].

From this study, it has been seen that the x-ray changes are mostly showing the sacralization of L5 vertebrae, as well as a reduction in space between L5 and S1 vertebrae. This led to an increased lumbosacral angle in the subject. The study concluded that Pilates form of exercises significantly reduced the angle, as can be seen in the x-ray. A study conducted by Silva PH, Silva DF, Oliveira JK, Oliveira FB, et al., 2018, on the effect of Pilates in subjects with chronic low back pain, significantly improved movement patterns, which aligned with the current study results [4]. The combined movement pattern commonly assessed in subjects with low backache conditions also improved in the subject, thus improving functional mobility.

A study conducted by Mohanty P, Pattnaik SS et al., [2], demonstrated sacral mobilization has significantly reduced the lumbar lordosis as well as pain-related complaints in such subjects. Vertebrae showed different mobility grades after palpating the lumbar spine and demonstrated significant differences with pre-post values.

Strengths

Physiotherapy demonstrates significant potential in sacralization management by reducing pain, improving radiological changes, and enhancing lumbar lordosis. Its individualized, non-invasive treatment approach highlights practicality, guiding clinicians toward effective rehabilitation strategies and improved functional outcomes in patients.

Limitations

The findings of this report are limited by the single-case design, which restricts generalizability, and the short-term follow-up, making it uncertain whether the benefits are maintained over time. Future studies with longer durations and yearly follow-ups are recommended.

5. Conclusion

Existing case report focuses on effectiveness of a structured physiotherapy protocol, including sacral mobilization, manual and mechanical lumbar traction, and Pilates exercises. This study shows that using a comprehensive, multimodal physiotherapy approach, especially the Pilates form of exercise, patients with sacralization can experience better functional outcomes and quality of life as measured radiologically and functionally.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethics Committee

This study followed ethical standards and received approval from the ethical and Protocol committee of Krishna Vishwa Vidyapeeth, Karad with reference number [KVV/IEC/83/2025].

Author Contributions

Study Design, SD and RC; Data Collection, SD and RC; Statistical Analysis, SD; Data Interpretation, SD and RC; Manuscript Preparation, SD and RC; Literature Search, SD and RC. All authors have read and agreed to the published version of the manuscript

REFERENCES

1. vat Dharati, K., Nagar, S. K., Ojaswani, M., Dipali, T., Paras, S., & Sucheta, P. (**2012**). A study of sacralisation of fifth lumbar vertebra in Gujarat. *National Journal of Medical Research*, 2(2), 211-213.
2. Mohanty, P., & Pattnaik, S. S. (**2021**). Effects of Sacral Mobilization in Patients with Spondylolisthesis of L5 Over S1. *Sports Med Rehabil J*, 6 (1), 1052.
3. Vanti, C., Saccardo, K., Panizzolo, A., Turone, L., Guccione, A. A., & Pillastrini, P. (**2023**). The effects of the addition of mechanical traction to physical therapy on low back pain? A systematic review with meta-analysis. *Acta Orthopaedica et Traumatologica Turcica,* 57(1):3-16. [PubMed] [CrossRef]
4. Silva, P. H., Silva, D. F., Oliveira, J. K., & Oliveira, F. B. (**2018**). The effect of the Pilates method on the treatment of chronic low back pain: a clinical, randomized, controlled study. *BrJP,* 1(1), 21-8. [CrossRef]
5. Shreyas, N., Shetty, S. K., & Mahalingam, V. V. (**2025**). Sacralization of lumbar vertebrae-prevalence and association with low back ache and radiculopathy. *International Journal of Research in Orthopaedics,* 11(1), 68. [CrossRef]
6. Vijayaraghavan, N., & Chandrasekaran, N. (**2017**). Clinical profile of a case of lumbar sacralisation naturopathy and physiotherapy management: a case report. *Int J Res Orthop,* 3(3), 643–5. [CrossRef]
7. Park, J. S., Lee, S. H., Kim, K. J., & Hwang, J. H. (**2024**). Lumbar sacralization and L4-L5 microdiscectomy: prospective cohort outcomes. *World Neurosurg X,* 21:100198. [CrossRef]
8. Kong, C. G., Park, J. B., Lee, T. J., & Chang, H. (**2008**). Sacralization of L5 in radiological studies of degenerative spondylolisthesis at L4–L5. *Asian Spine J,* 2(1):15–21. [PubMed] [CrossRef]
9. Luoma, K., Vehmas, T., Raininko, R., Luukkonen, R., & Riihimäki, H. (**2004**). Lumbosacral transitional vertebra: relation to disc degeneration and low back pain. *Spine (Phila Pa 1976),* 29(2), 200–5. [PubMed] [CrossRef]

10. Dai L. (**1999**). Lumbosacral transitional vertebrae and low back pain. *Bull Hosp Jt Dis,* 58(4), 191–5. [PubMed]
11. Konin, G. P., & Walz, D. (**2010**). Lumbosacral transitional vertebrae: classification, imaging findings, and clinical relevance. *American Journal of Neuroradiology*, 31(10), 1778-86. [PubMed] [CrossRef]
12. Thapa, P., Rayamajhi ,M., Amatya, B. R., Shah, A., Pant, S., & Kunwar, B. R. (**2024**). Prevalence of Lumbosacral Transitional Vertebrae among Patients Presenting with Low Back Pain at a Tertiary Care Hospital. *Medical Journal of Shree Birendra Hospita*l, 23(2), 18-21. [CrossRef]