



# Comprehensive strategies for spondylolisthesis management: A narrative review

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## Abstract:

Spondylolisthesis, characterized by the displacement of one vertebra over another, is a significant contributor to low back pain, with varying presentations and etiologies. This condition often stems from spondylolysis, a fracture in the vertebral arch, particularly affecting the L5 vertebra. Sometimes L4 vertebra can also be affected with spondylolisthesis. While some patients may remain asymptomatic, mechanical stress can lead to pain and disability. Multifidus atrophy, facet joint degeneration, and disc abnormalities are common findings in spondylolisthesis cases. Classification using the Meyerding system aids in grading the severity of vertebral displacement, which correlates with clinical symptoms and treatment approaches. Conservative therapies like physiotherapy including cupping therapy, acupuncture, and manipulation techniques, offer promising results in alleviating pain and inflammation associated with spondylolisthesis. This abstract provides a comprehensive overview of the current understanding and management strategies for this debilitating condition, emphasizing the importance of conservative treatments in improving patient outcomes.

1241

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## Introduction:

Spondylolisthesis is one of the main factors that determine low back pain. Spondylolisthesis is the name for when one vertebra slips over another. SPL can be divided into two categories when taking into account the degeneration and isthmic terms. If spondylolysis is involved, the outcome could be spondylolisthesis. [1]The most typical locations for SPL presentations are L over S1 and L5 over L4, but low back pain can also occur at other levels. Research has determined that spondylolysis is a clinical condition resulting in injury to the vertebral arch. Therefore, spondylolysis is indicated by fracture and structural damage to the pars interarticularis, which further results in vertebral sliding over one another.

Most cases of spondylolysis (85%–90%) impact the L5 vertebra, with the L4 vertebra being affected less frequently (5%–15%). Spondylolisthesis develops following spondylolysis as a result of a congenital defect and a post-injury consequence caused by an interrupted pars interarticularis. [3] While some spondylolysis patients experience pain and stiffness, many individuals show no symptoms as all. The factor that results in a fractured pars interarticularis, which in turn causes pain and eventually incapacity, is mechanical stress.[4] Spondylolisthesis is the term used to describe the anterior, lateral, or posterior sliding (displacement) of one vertebral body over another. Vertebral forward displacement happen following pars interarticularis fault.



We refer to this condition as isthmic spondylolisthesis. Multifidus (stabilizer of the back region) atrophy has been observed in a number of SPL patient investigations [2, 5]. Arthritis change and anomalies in the intervertebral disc spaces point to degenerative SPL. SPL has been connected to the deterioration of facet joints, reduced thickness of the stabilizer muscles during contraction and at rest, and overuse of the stabilizer muscles in adults and the elderly. [2, 7] After ligamentum flavum thickening, disc bulging, facet joint hypertrophy, disc protrusion, and degenerative changes to the spine, the spinal canal becomes narrower. [18] Central stenosis is the narrowing of the central canal of the spine at the cauda equine nerve roots.

SPL could also be defined with the direction of displacement such as anterior SPL and posterior SPL. Anterograde SPL is the forward displacement of L5 over S1 or L4 slippage over L5, while retrograde SPL means backward displacement of the vertebra L5 over S1 or L4 over L5. Grade 1 spondylolisthesis is considered as 25%, grade 2 is 50%, grade 3 is 75% and grade 4 is 100%. It's noteworthy to note that just 23% of patients with SPL disorders report clinical difficulties before the age of 20, considering that most individuals with these diseases are asymptomatic. [1] The recognized classification for spondylolisthesis is the Meyerding system (grades I through V), which coincides with the percentage of superior disc translocation over the inferior disc. severe disc translation is indicated by Grade IV and V spondylolisthesis, which is usually the result of isthmic spondylolisthesis since notable degrees of translation usually need a severe lesion to the pars interarticularis. The increased mobility of the slipped vertebra and the antero-inferior pressure on the disc may cause increased pressure on the spinal nerve and a decrease in intervertebral foramina. [2, 5]

Research has indicated that isthmic spondylolisthesis and spondylolysis happen by accident in 2.5–3.5% of kids who get CT or MRI

scans for unrelated pelvic or abdominal conditions. Hyper mobility at the SPL level is often compensated for by hypo mobility at other spinal levels, primarily the thoracic ones, and vice versa [2]. An alternate treatment combining cupping therapy with acupuncture is a traditional treatment that has been around for a while. Although there is a dearth of research on physical medicine, the popularity of this treatment in terms of lowering pain, inflammation, and soreness in the muscles cannot be disregarded. Whether it is primary or secondary makes no difference. Cupping therapy has proved a successful combination with conventional physiotherapy for treating low back pain in female patients. Nociceptors activation brought on by this process stimulates diffuse inhibitory control. Reduction of pain and inflammation is the final result. [8, 9] The criteria for manipulation definition, when manual force is utilized to treat hypo-mobile joints, are low-amplitude, high-velocity thrust. This lessens stiffness and back pain associated with spinal disorders. The purpose of this review study is to summaries and highlights the most cutting-edge conservative therapy options for spondylolisthesis.

#### **Search methods:**

A manual search was done using Google Scholar and Pub Med to find information about spondylolisthesis operations. Using the terminology listed in the Medical Subject Headings of the U.S. National Library of Medicine (Mesh) accessible through Pub Med, a search was conducted across a variety of studies and review articles. The terms "spondylolisthesis," "physiotherapy," "physiotherapy treatment," and "physical exercise" were used to search for articles. This study comprised case studies and randomized clinical trials (RCTs). Only the selection criteria to locate the papers are available for research published in the English language.

#### **Search through Google Scholar:**

Generally in this study word spondylolisthesis was used to search the publications. If the time



period was ignored, we discovered 79400 research publications about spondylolisthesis. Additionally, 4111 review articles were located. Results under the time constraint from 2016 to 2022 totaled 18400 articles. Review articles were counted as 332. When we searched for phrase "physiotherapy treatment for spondylolisthesis" on Google Scholar, we found 221 review articles with a time constraint of 2016–2022. When we searched for "physiotherapy treatment for spondylolisthesis at lumbar region," we found even more results. There were 291 review articles that we received between 2016 and 2022. Using the specified search term "physiotherapy treatment for spondylolisthesis at L4-L5 level," thus, we were able to locate 52 review articles matching with my title of the study between 2016 and 2022.

#### **Data searching through PubMed:**

Using this search engine, 6985 research articles about spondylolisthesis and related articles were located without the need for a filter. 663 review articles were found in an instant during the search. By employing the search term "spondylolisthesis," the timeline search yielded 2983 research articles and 233 review articles. Searching for "spondylolisthesis physiotherapy treatment," 198 research articles were located. Of them, 33 were found within a certain time limit, and 69 were found through research article filtering. The score after applying the filter was 13 review articles. 184 articles were found when the search term "spondylolisthesis physiotherapy at lumbar region" was used. Looking for a skewed viewpoint on the article score was 39. Using review articles, the same search yielded seven. The time frame (filter) used in all of these searches was from 2016 to 2022.o

Conclusion is that we get collected a total of 65 review articles after specified search and removing the duplicates. Ultimately this study has utilized total 24 review articles that were found to be relevant for this current study.

#### **SPL distribution, pattern and determinants:**

Spondylolisthesis comes in two flavors: isthmic and degenerative. The conventional explanation for isthmic spondylolisthesis is the progression of previous spondylolysis. Sports activities put athletes at a high risk of developing spondylolysis due to lumbar spine damage to the pars interarticularis. There is a chance that this harm will be bilateral. Spondylolysis can also occur as a result of medical conditions. Spondylolysis is more common in people with kyphosis, spina bifida occulta, and other hereditary spinal abnormalities. Degenerative spondylolisthesis is quite gender and age-specific in its occurrence. Degenerative spondylolisthesis is uncommon in both sexes until the age of fifty. After that, however, women are more likely than men to develop it. [1, 11]

#### **SPL condition and their physiology:**

Many theories regarding the origins and potential therapies of low back pain have been put up, despite the fact that the cause of over 80% of cases remains unknown. One notion suggests that there may be a change in the paraspinal muscles and abdomen in patients with chronic low back pain. Between 60% and 80% of individuals are predicted to have low back pain at some point in their lives. The pars interarticularis is usually repeatedly strained, especially because to hyperextension, which results in spondylolysis. [1, 6, 12, 13] The majority of researchers and medical experts think that aberrant segmental movement, zygapophyseal joint injuries, and related ligament damage are the main causes of segmental instability.

Because of the neuromuscular control over the lumbar spine, mechanical low back pain may have a pathomechanical basis. In the past, the radiological diagnosis of spondylolisthesis in patients with chronic low back pain associated with this outcome has been one of the most obvious indicators of lumbar segmental instability. [13]Degenerative spondylolisthesis affects women almost six times more frequently than it does men. The degree of disc slippage is commonly measured using the

Meyerding grading system, which assigns a grade from I to V. Neurological complications are more likely in high grade spondylolisthesis, which is correlated with Meyerding grade III or above, since the spinal cord and neural tissues are compressed. [2, 5, 6]

Because of the increased strain on the pars interarticularis, early disc slippage can potentially result in spondylolysis. Lower back repetitive motions might aggravate congenital sickness, which is often complicated. Trauma that fractures a part of the posterior column of the spine other than the pars causes traumatic spondylolisthesis, which often coexists with other injuries. The pars interarticularis may split in the presence of spondylolysis (Figure 1). Spondylolysis is a common condition in young individuals who overstrain for sports and can be congenital or caused by a stress fracture in the bone. The pars interarticularis is prone to fracture during spinal hyperextension, especially in conjunction with rotation or when absorbing a force during landing. [1, 3, 6, 11]

#### **Diagnostic radiology:**

MRI is advised even though CT and MRI scans are commonly used to identify LSS and verify the presence of spinal stenosis. When the diameter in the lumbar spine is 12 mm or less, it is considered to be indicative of central canal stenosis. One of the basic radiographic characteristics is the predominant finding of spondylolisthesis on a lateral view of forward (or backward) displacement of L4 on L5, or, less frequently, L5 on S1 or L3 on L4 in the presence of an intact neural arch. In contrast to a simple displacement forward or backward, the "listhesis" is a rotating defect. [11]

A radiograph is the first thing to look for when spondylolisthesis is suspected. The best way to diagnose spondylolisthesis is still up for debate, and it's not apparent how the choice of radio diagnostic methods might impact clinical care. Standing posteroanterior and lateral radiographs of the thoracolumbar spine are commonly used, in addition to supine oblique views of the lumbosacral spine, to assess

suspected spondylolysis or spondylolisthesis. [11]

#### **Categorization:**

According to the Meyerding scale, there are five grades: I denote complete vertebral body slippage, II represents 25% to 50% vertebral body slippage, III represents 50% to 75% vertebral body slippage, IV represents 75% to 100% vertebral body slippage, and V represents complete vertebral body slippage. For the continuous assessment of the amount of disc slippage and the progression of vertebral displacement, this grading scheme is crucial. Another useful grading system that separates the different etiologies of spondylolisthesis into five distinct groups was developed by Wiltse et al. [1, 13, and 14]

Isthmic spondylolisthesis is linked to type II, which is subdivided into sorts IIA and IIB. Anterior vertebral slippage (Type IIA) is caused by stress fractures of the pars interarticularis. Type IIB is caused by frequent fractures and healing, which extend the pars interarticularis. The vertebrae slip anteriorly in both kinds. Type III arthritis which weakens the ligamentum flavum and causes the vertebrae to slip anteriorly is the most common cause of degenerative spondylolisthesis. [1, 14] Type IV trauma is linked to traumatic spondylolisthesis caused by high energy trauma. Diseases such as osteoporosis, lytic bone tumors, and osteopetrosis can cause Type V, which is linked to pathologic spondylolisthesis. Laminectomy, one of the most common iatrogenic causes of type VI, is spinal surgery. Spondylolysis is usually asymptomatic and can happen to be found by accident when doing a radiological examination. The pain the patient is feeling in their lower back usually gets worse when their back is extended. The child may have lumbar hyperlordosis based on a visual assessment. In situations of severe spondylolysis, there may be a noticeable drop-off from the lumbar spine to the sacral spine and lumbosacral kyphosis. Another common finding for which the underlying mechanism is still unknown is



hamstring contracture. [1, 2] Patients frequently lament their symptoms, which are usually brought on by mechanical or spinal stenosis.

Spinal stenosis that results in weakness and paresthesia when moving or standing, as well as low back pain that travels to both proximal lower limbs. The manifestation of radiculopathy symptoms may be attributed to spondylolisthesis, a condition in which the nerve roots get crushed [15]. Numbness, tingling, weakness, or pain in the lower back is signs of lumbar vertebral spondylolisthesis. Patients who perform certain back-extension-related activities may also have severe shooting pains down their legs in addition to other complaints. In order to reduce discomfort and release pressure on the nerve roots, the patient usually assumes a kyphotic lumbar position. [1]

Hamstring stiffness and lower back or buttock pain that worsens with spinal extension are common complaints from patients with isthmic spondylolisthesis. This radiculopathy was caused by compression of the nerve roots in the area of the vertebral body's anterior slippage. Sitting or bending forward are two positions that encourage spinal flexion and can help ease the ache. Spinal extension and/or exercise often exacerbate this pain. This radiculopathy was caused by compression of the nerve roots in the area of the vertebral body's anterior slippage. [1, 14]

Sitting or bending forward are two positions that encourage spinal flexion and may help easing the ache. Spinal extension and/or exercise often exacerbate this pain. Although spondylolisthesis often presents with no symptoms, a thorough history taking and physical examination of the musculoskeletal and neurological systems can help make an accurate diagnosis. [1, 6, 16]

#### **How to diagnose SPL:**

Although spondylolisthesis often presents with no symptoms, a thorough history taking and physical examination of the musculoskeletal

and neurological systems can help make an accurate diagnosis. Even though spondylolisthesis often presents with no symptoms, a complete history-taking procedure and an extensive musculoskeletal and neurological physical examination are necessary for a correct diagnosis of spondylolisthesis. [1] The earliest theory linking menopause and DS was based on the fact that those postmenopausal women had a higher incidence of DS than age-matched men. Before 50 years of age, DS is rare and as previously shown, congenital spondylolisthesis is actually more common in men. Three distinct disorders have been connected to postmenopausal women's low levels of female sex hormones: Higher frequency of disc degeneration and disc space constriction [2, 6, 16], increased prevalence of osteoarthritis, particularly that of the facet joints, and general laxity of the paraspinal ligaments [5].

For further workup when there is a significant clinical suspicion of spondylolisthesis despite normal imaging results, single-photon emission CT of the lumbosacral spine is useful. A thin-section CT scan with a reverse gantry angle can also be used to evaluate the severity of spondylolisthesis. Static X-rays are considered the gold standard for the diagnosis of SPL and are also considered the threshold for "macroinstability" when a translation of more than 3 mm in the sagittal plane is observed. Standing lateral X-rays are more sensitive than conventional supine MRIs for identifying degenerative SPL. [1, 6]

#### **How to manage SPL:**

Because there aren't many noteworthy clinical trials devoted to the treatment of spondylolysis, creating an efficient treatment protocol for conservative and surgical treatment is difficult. Conservative therapy is usually the first line of treatment for young children with spondylolysis. Bracing, activity restriction, physical rehabilitation, and pain control are typical conservative care components. [1] For patients whose physical examinations did not





show any relevant clinical instability, joint mobility and muscle relaxation were the primary goals of the treatment strategy at first? Exercises involving active range of motion and stretching were created to lessen spinal stiffness. Physiotherapy is widely recognized as an efficacious treatment for spinal disorders, encompassing flexion exercises, analgesic treatments, and orthoses. Since an integrated exercise programme greatly enhances pain, lumbar range of motion, neurological flexibility, and quality of life, it can be used as a therapy plan for lumbar spinal stenosis. [18]

Dynamic balance, strength, and endurance workouts may have further decreased pain and impairment levels, facilitating the creation of new exercises and boosting patient exercise self-efficacy. [1, 6] Regular home exercise regimen completion likely improved patients' fitness, which is important for LBP patients' pain management and health promotion. Exercise development is encouraged, starting with weighted squats and stair training and progressing to weighted carries, lunges, and dynamic balancing training. [14]

In certain instances, physical treatment has been demonstrated to alleviate LBP brought on by spondylolysis and SPL [6, 12]. Physical therapy, bracing, activity restriction, and pain management are the pillars of conservative treatment. Opioids, NSAIDs, and muscle relaxants are all useful tools for treating pain. [14] Most physicians start by giving their patients one to two days of rest before administering an anti-inflammatory medication for a short while, according to Vibert et al. After two weeks, physical therapy is a good course of action if the patient's symptoms have not improved. Numerous more studies, many of which Kalichman and Hunter have cited, have assessed the efficacy of various conservative treatment strategies, such as bracing, flexion/extension strengthening exercises, stabilization exercises, and physiotherapy. [1]

Exercise in conjunction with cognitive-behavioral therapy was found to be more effective than exercise alone in reducing kinesiophobia-related discomfort, disability, and dysfunctional thought patterns while also enhancing quality of life (Monticone et al.). Radiographic results, function, and range of motion are all improved in spondylolisthesis patients by stretching tight muscles (hip flexor, hamstring, and piriformis), adding sacral mobilisation to William flexion exercises, and maintaining core stability. Journal of Sports Medicine and Rehabilitation, Patitapaban Mohanty and colleagues, 2021 [13] Spondylolisthesis is the term for the "slipping" or forward movement of one vertebra over another. The conservative management of lumbar spondylolisthesis includes spinal stabilization exercises, self-stretching of tense muscles, and William's flexion exercise. [19]

In adolescents with acute lumbar spondylosis, union of the bones may occur; hence, this may serve to halt the progression of spondylolisthesis. [20] Following cupping therapy, patients' visual analogue pain scales showed a significant improvement. There aren't many researches that support the effectiveness of this technique for treating low back pain. [9] Following spondylolisthesis, dry needling may be beneficial in curing the condition. Although it cannot be used to treat spondylolisthesis directly, the fairly invasive dry needling method can be used to manage the condition's aftereffects. [21, 22] Treatment with Shi-style manipulation may be quite beneficial in cases with degenerative lumbar spondylolisthesis. If joint displacement and channel obstruction are the root causes of the issues, the Chinese medicine's collateral theory and channels have been proven to be effective. [23]

#### **Conclusion:**

Despite spondylolisthesis is usually asymptomatic, neurogenic claudication and low back pain may results, spinal movement and extension can aggravate the anterior spondylolisthesis into account and vice versa.



Fist line of conservative treatment starts with physiotherapy, NSAIDs, analgesics, muscle relaxants, physical therapy, low-impact exercises, and steroid injections. Other symptomatic management techniques (not curable) include cupping therapy, dry needling, acupuncture, and Shi-manipulation. This review was focused on individuals with grades I and II spondylolisthesis. Exercises for lumbar spine flexion can be used to alleviate low back pain associated with spondylolisthesis; this is applicable to cases of anterior spondylolisthesis and the opposite is true for posterior spondylolisthesis. In clinical practice, lumbar stabilization exercises involving core strengthening, the erector spinae muscle group, and the abdominal group of muscles should be utilized daily to provide lumbar stability. When a spondylolisthesis lesion occurs in the spine (L4-L5 and LS-S1), sacral mobilisation may be crucial.

It is also advised to use myofascial release for paraspinal muscular spasm, piriformis and hip flexor exercises, and thoracic mobilisation. Teach posture awareness and safe lifting procedures to the patient. Additionally, the patient was instructed to wear a lumbosacral brace only for exercise and travel. For the treatment of lumbar spondylolisthesis, manual therapy utilizing passive stretching, myofascial release and central PA mobilisation is more efficacious than conventional home exercise regimens. [19] The three mainstays of conservative treatment for spondylolisthesis are bracing, medication, and rest. The two basic surgical treatments for spondylolisthesis are decompression and instrumented fusion. When it comes to spondylolisthesis, conservative therapy is quite successful in treating both grade-1 and grade-2 cases. [1, 24]

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