ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 16 Issue, 02, pp. 70047-70053, February, 2026
https://doi.org/10.37118/ijdr.30575.02.2026

RESEARCH ARTICLE OPEN ACCESS

A SYSTEMATIC REVIEW OF PHYSIOTHERAPY FOR SPONDYLOLYSIS AND SPONDYLOLISTHESIS

***Rachna Kocheta**

Assistant Professor, Institute of Management and Research, MGM University, Aurangabad (MS)

ARTICLE INFO

Article History:
Received 17th November, 2025
Received in revised form
28th December, 2025
Accepted 29th January, 2026
Published online 27th February, 2026

Key Words:

Stress, Management, Workplace,
Human Resource Department And Stressors.

****Corresponding author:***
Rachna Kocheta

ABSTRACT

The purpose of this systematic review was to assess the evidence concerning the effectiveness of physiotherapy intervention in the treatment of low back pain related to spondylolysis and spondylolisthesis. A literature search of published and unpublished articles resulted in the retrieval of 71 potential studies on the subject area. Fifty-two of the 71 articles were studies, and these studies were reviewed using preset relevance criteria. Given the inclusion and exclusion criteria chosen for this systematic review, there were very few acceptable studies and only two studies met the relevance criteria for the critical appraisal. Both studies provide evidence to suggest that specific exercise interventions, alone or in combination with other treatments, have a positive effect on low-back pain due to spondylolysis and spondylolisthesis; however, the type of exercise used was different in the two studies. In this review, very few prospective studies were found that examined the efficacy of physiotherapy on the topic

Citation: Rachna Kocheta. 2026. *"*A systematic review of physiotherapy for spondylolysis and spondylolisthesis*". International Journal of Development Research*, 16, (02), 70047-70053.

INTRODUCTION

A systematic review is an evaluation of existing literature using a research format. As such it constitutes research; it poses a question, identifies a population and draws a sample (Magee 1998). Published and unpublished studies are assembled using explicit searching methods, and a predeter- mined protocol of evaluation is used with inclusion and exclusion criteria (Jefferson & Deeks 1999, p 225). Research papers are read selectively and critically, measurements are analysed, and conclu- sions are drawn based on the scientific merit of the research findings. It is hoped that the findings of a systematic review will help guide practitioners in prescribing effective interventions for their patients (de Vet et al. 1997) and provide insight into future research directions. When doing a systematic literature review, large randomized controlled trials (RCTs) are sought, as they provide the strongest evidence (Stein & Cutler 1996; Magee 1998). Internal validity of the study, with an RCT, is enhanced as extraneous factors are controlled, and as randomization of subjects reduces selection bias (Portney & Watkins 2000, p 167). Valid and reliable measures, as well as valid, reliable, and sensitive measurements and instruments insure that data are accurate and meaningful (Warren 1994). In addition, having outcomes measured by independent (blinded) observers, or by the patients themselves, further enhance the validity of the study. To control for confounders and to assess the external validity of the study, inclusion and exclusion criteria should be clearly stated and details provided on the study population. Among these details, such things as agreement to participate, attrition and the reasons for subjects being lost to follow-up must be included. In treatment studies, pretreatment clinical signs and symptoms have to be documented, and treatment interventions explained in enough detail to allow for replication of the study (Magee 1998). The purpose of the present systematic review was to examine research studies assessing the efficacy of physiotherapy interventions in the treatment of low-back pain related to spondylolysis and spondy- lolisthesis.

Aetiology: Though the exact cause of spondylolysis is unknown, theories have evolved implicating both congenital and developmental causes (Hensinger 1989). The basis of the 'congenital theory' is that there is a genetically predisposed weakness in the pars inter- articularis (Motley et al. 1998), and evidence for the theory is found in the increased incidence of both spondylolysis and spondylolisthesis in first-degree relatives of children with these conditions (Lonstein 1999). Genetic predisposition alone, however, is unlikely to be the sole cause, as lesions are not present in infants or pre-ambulatory children, and are also not found in those who have never walked (Newell 1995). The basis of the 'developmental theory' is that a fatigue fracture develops as a gradual response to mechanical usage (Newell 1995). It is believed that microtrauma or microstress causes this fracture of the pars interarticularis (Lonstein 1999) and though an episode of minor trauma often initiates symptoms, there is seldom a history of severe injury to the low back (Hensinger 1989). Supporting this hypothesis further, pars defects can be reproduced by fatigue loading

in vitro (Newell 1995). However, these reproduced defects have been bilateral, and, thus, the presence of unilateral defects may suggest a congenital association (Newell 1995). Mechanically, the interarticular area, particularly that of the fifth lumbar vertebra, is in a position of special vulnerability, absorbing the force of weight due to the lumbo-sacral alignment and the normal lumbar lordosis of the spine (Newell 1995). The normal flexion contractures of the hip seen in childhood (Hensinger 1989) and/or poor posture result in an accentuated lumbar lordosis, and further increase the impact forces in this region. The pars interarticularis is especially susceptible to damage in the growing child, due to incomplete ossification of the neural arches (Johnson 1993). In young athletes, it is believed that repetitive motions and/or overuse, on an already compromised region of the vertebra, cause fracture or elongation of the pars interarticu- laris (Johnson 1993). In summary, though genetic factors may predispose to spondylolysis, it is likely that mechanical forces related to normal weight bearing, posture, repetitive activities and mild trauma, especially on an immature spine, combine to produce the initial defect (Hensinger 1989; Lonstein 1999). Spondylolisthesis, as stated previously, usually results from spondylolysis. The normal resistance to forward displacement of the vertebra is provided by the posterior facets, ligaments and the intervertebral disc (Magee 1982). With fracture or elongation of the pars interarticularis, however, the posterior elements are compromised (Lonstein 1999) and the vertebral body is allowed to slip forward, resulting in instability (Magee 1982). Narrowing of the spinal canal will occur if posterior elements also slide forward (Magee 1982) and, as a result, symptoms may develop.

Signs and symptoms: The presenting signs and symptoms normally include pain, restricted range of motion, paraspinal muscle spasm, flattening of the sacrum and a peculiar gait (Magee 1982; Johnson 1993; Osterman et al. 1993. Pain is usually reported as mild to moderate, and is initially a dull ache that gradually increases in intensity (Motley 1998). Pain is commonly localized to the paraspinal region,gluteals (Hall & Brody 1999) and posterior aspect of the thighs (Barashetal. 1970). Initially pain may be associated with a very mobile spine, with symptoms appearing at extremes of lumbar range of motion only. In the adolescent athlete, extension- and rotation-type movements, specific to the individual's sport, are reported to exacerbate symptoms (Johnson 1993). Progression results in hamstring tightness (Osterman et al. 1993), posterior tilting of the pelvis, and a flexed hip and knee posture (Barash et al. 1970). The individual may walk with a stiff legged, short-stride gait (Barashetal. 1970; Hensinger 1989) and a characteristic pelvic 'waddle' (pelvic rotation with stepping) may be observed (Hensinger 1989). On examination, pain is reproduced with the one- legged standing lumbar extension test, and with spondylolisthesis, a step deformity in the lumbar spine may be observed or palpated (Magee 1997). In moderate to severe cases, marked limitation of trunk flexion range of motion is often seen (Barash et al. 1970) and a limited straight leg raise found (Barash et al. 1970; Magee 1982).

Treatment: In the majority of symptomatic cases of spondylolysis and spondylolisthesis non-operative treatment is recommended. Physiotherapy is the most common method used to apply non-operative treatment and may include the use of modalities for pain relief, bracing, exercise, electrical stimulation and activity modification (Fellander-Tsai & Micheli 1998; Sza- palski 1999). Physiotherapy treatment is recom- mended to reduce pain, to restore range of motion and function, and to strengthen and stabilize the spine (Fritz et al. 1998; Hall & Brody 1999). Though non-operative treatment is reported as being effective in relieving the symptoms of back pain due to spondylolysis and spondylolisthesis (Szapalski 1999), few studies have been done examining the efficacy of the various treatment interventions. Operative treatment is indicated to alleviate pain in patients not responding to conservative treatment, and to prevent progression of the slip in those with severe slip (>40%) of the vertebrae (Fritz et al. 1998; Szapalski 1999). As costs and complications due to surgery are high and long-term benefits uncertain (Fritz 1998), further study into the efficacy of non- operative treatment is warranted.

METHODS AND MATERIALS

The process of systematic reviewing involves thor- ough detective work aimed at identifying all studies on a specific topic. Studies are chosen based on preset criteria that may include, for example, study design, type of experimental intervention and specific out- come measures. For this review, the literature was searched for published studies and unpublished studies on physiotherapy interventions in treating spondylolysis and spondylolisthesis. Two indepen- dent investigators screened the titles of articles found on the databases, and if available, the abstract of the article as well. If either or both investigator felt that the article potentially met the inclusion criteria, or if there was inadequate information to make a decision, copies of the article were obtained.

Criteria development: Criteria were developed at the beginning of the study to determine keywords to use in the search strategy, and to help determine whether the studies found were relevant to the topic area of this systematic review. The inclusion and exclusion criteria were deemed important for ensuring internal validity of the study. The base criterion required that the study include activities that could be classed as physiotherapy interventions within the scope of practice of physio-therapists in Canada. This requirement meant that a researcher from any discipline could undertake the study, as long as one or more of the interventions was within the scope of practice of Canadian physio- therapists. Although randomized controlled studies were sought, because of the clinical nature of the topic and the paucity of research in the physiotherapy field in general, other research methods were considered eligible for the review. The investigators felt that other research methods might demonstrate differ- ences and suggest important research hypotheses. However, to ensure that some degree of scientific rigour was maintained it was determined that only prospective studies would be included and that quantitative studies were required to have a control group (Lohr & Carey, 1999). Further inclusion criteria used to determine whether the study was relevant for this overview were: (a) male and female humans; (b) symptomatic low-back pain; (c) within the age of 10–60 years; (d) lumbar spine involvement and (e) radiographic evidence of spondylolysis or spondylolisthesis in the lumbar spine. The exclusion criteria were developed to limit the influence that extraneous factors might have on the results of the treatment intervention (confounding variables), and in an attempt to limit the study to true symptomatic spondylolysis and spondylolisthesis. Exclusion criteria for this overview were: (a) no neurological or autonomic deficits; (b) no other fracture or bony abnormalities; (c) no rheu- matic disease and (d) no other spinal problems. For outcome measurements, the study had to include one or more of the following: range of motion, pain, functional outcome measure or patient satisfaction. The information was developed into a relevance tool (Table 2) that was used by the investigators to independently evaluate the retrieved papers. Each criterion was graded on a yes/no basis—that is, the published study had to provide enough information to adequately meet the criterion. All criteria on the rating form had to be met for the study to be evaluated at the next level, the Critical Appraisal. Once the criteria were developed, a group of 10 studies were gathered. Interrater reliability of inde- pendent initial grading of these papers using the relevance tool was 100%. The next level of the systematic review, the Critical Appraisal, involved rating the accepted studies to determine internal and external validity (Table 3). The two investigators independently reviewed the studies. Each study was analysed based on specific predetermined criteria. These criteria were then rated as pass (P), moderate (M) and fail (F). The rating system was based on a similar rating system devel- oped by de Vet et al. (1997). The Critical Appraisal was then taken to the final stage for an overall assessment of the study (Table 4). At this point, the study was graded as weak, moderate or strong, depending on how well it met each of the critical appraisal criteria. All criteria were weighted equally.

RESULTS

A total of 71 articles were obtained through the literature search; 52 articles were studied and were reviewed using the relevance tool (Table 2). Out of the 52 studies reviewed, only two studies met all selection criteria (Spratt et al. 1993; O'Sullivan et al. 1997). Clarification was required by one author (Spratt et al. 1993) to verify that one specific criterion was met and this was done by e-mail communication. None of the other studies came close to meeting all criteria. There was 100% agreement between re- viewers about the rating of all papers. The two studies that were evaluated at the Critical Appraisal level were initially rated as 'weak' . However, after e-mail communication with one of the authors, one study (O'Sullivan et al. 1997) was re-rated as strong. The results of the Critical Appraisal for each of the two studies are provided in Table 5.

Table 1. Physiotherapy effectiveness project relevance tool—primary studies (Study: Physiotherapy intervention for low-back pain related to spondylolisthesis and spondylolysis)

Instructions for completion		
1. Circle Y or N for each relevance criterion		
2. Record inclusion decision: article must satisfy all relevant criteria 3. Ensure that no exclusion criteria are included		
4. Record if additional references are to be retrieved 5. Complete validity form for articles to be included		
Relevance criteria		
1. Does this article evaluate a physiotherapy intervention or program?	Y	N
2. Is the intervention within the scope of physiotherapy practice in Canada? 3. Are the subject inclusion criteria covered?	Y	N
a. male/female humans	Y	N
b. low back pain	Y	N
c. age 10–60	Y	N
d. lumbar spine involvement	Y	N
e. radiographic evidence of spondylolisthesis and spondylolysis 4. Are patient exclusion criteria included?	Y	N
a. no neurological/autonomic deficits	Y	N
b. no other fracture/bony deformities	Y	N
c. no rheumatic disease	Y	N
d. no other spinal problems	Y	N
5. Is one or more appropriate outcomes (ROM, Pain, outcome measure, patient satisfaction) measured? 6. Is the article a prospective study?	Y	N
● (allocation, exposure to intervention occurs during research period and prior to measurement of outcome)	Y	N
7. If a quantitative study, is there a control group?	Y	N
Reviewer decision		
1. Include in critical appraisal (Yes = Y to all relevance criteria) If yes, please complete validity form	Y	N
2. Additional references	Y	N
If yes, mark items on reference list of article		
If discreepancy inclusion decision		
Reason for discrepancy		
Oversight	Y	N
Differences in interpretation of criteria	Y	N
Differences in interpretation of study	Y	Y
Final decision: include in study	Y	N

Table 2. Critical appraisal—included studies (Study: Physical therapy intervention for low-back pain related to spondylolisthesis and spondylolysis (included studies))

1. Type of study i. random/quasirandom ii. cohort/before-after iii. case control/cross-sectional iv. descriptive 2. Confounders controlled i. age ii. sex iii. classification iv. medication	(I) (II) (III) (IV) Y Y Y Y	(P) (M) (F) (F) N N N N	• Data collection methods • self-reported (pain, functional outcome) • inter-rater reliability Y N N/A • intra-rater reliability Y N N/A • reliable test inst. Y N • validity test inst. Y N • sensitivity Y N • well described Y N • single blind assessor (pain, ROM, functional outcome)			
				inter-rater intra-rater	reliability reliability	Y Y N N N/A
				reliable test inst. validity test inst. Sensitivity well described		Y Y Y Y N N N N
• Differences between groups not statistically controlled • P=all M=2–3 F=0–1 • 3. Agreement to participate • i. >80% (P) ii. 60–80% (M) iii. < 60% (F) iv. cannot tell (F) • 4. Intervention • i. acupuncture ii. mobilization			• clinician performed (ROM, functional outcome) • inter-rater reliability Y N N/A • intra-rater reliability Y N • reliable test inst. Y N • validity test inst. Y N • sensitivity Y N • well described Y N			
iii. manipulation iv. massage v. superficial heat			Outcome: 6 or all=P, validity +(3–4)=M, validity + (0–2)=F N/A is not a fail for this category			
• bracing • deep heat viii. ice • ultrasound • traction • exercise • education • TNS/IFC/HVG • Other, pls. specify • Physiotherapy treatment • well described Y N • specific to tested groups Y N P=2 M=1 F=O • (well described: dosage, time, placement)			• Subjects starting and finishing study • immediate >80% (P) 60–80% (M) >60% (F) • ii. post-treatment >80% (P) 60–80% (F) < 60% (M) • iii. follow-up >80% (P) 60–80% (M) >60% (F) • 9. External validity Y N • 10. Limitations i. Major • ii. Minor • 11. Was there statistical test(s) of the intervention effects? Y N			
6. Sample size i. large ii. medium iii. small <20	>100 20–100 <20	(P) (M) (F)				

Table 3. Critical appraisal—final decision (Study: Physiotherapy intervention for low back pain related to spondylolisthesis and spondylolysis (final decision))

Overall assessment of the study 1. Type of study	P	M	F
2. Confounders controlled	P	M	F
3. Agreement to participate	P	M	F
4. Intervention	P	M	F
5. Physiotherapy treatment	P	M	F
6. Sample size	P	M	F
7. Data collection methods i. Pain	P	M	F
ii. ROM iii. Patient satisfaction/outcome 8. Subjects starting and finishing study i. Immediate ii. At end of treatment intervention iii. At follow-up (6 month) Review rating Weak (any F)	P P P P P Moderate (No F; < 4 P)	M M M M M	F F F F F Strong (No F; 4+P)
If discrepancy in validity decision between reviewers Reason for discrepancy i. Oversight ii. Differences in interpretation of criteria iii. Differences in interpretation of study Final decision Weak Moderate			Strong

Table 4. Results of critical appraisal

	O'Sullivan et al.	Rating: O'Sullivan	Spratt et al.	Rating: Spratt
Type of study Confounders controlled age, sex, classification, medicine	Randomized controlled trial Age: 16–49, sex: males >females Classification: limited to isthmic spondylolysis and spondylolisthesis (degree of slip: 0–2) Medication: monitored *No significant differences between groups	P P	Randomized controlled trial Age 18–60 years: age and gender not equal across groups Classification: both spondylolytic (isthmic) and degenerative spondylolisthesis included *Stringent inclusion criteria to control for age-related conditions Medication: no information	P F
Agreement to participare Physiotherapy Intervention Intervention described in enough detail to allow for replication	100% Stabilization exercises Treatment group: well described and could be reproduced based on description Control group: not clearly outlined or standardized	P Yes M	provided 100% Bracing Exercise Insufficient details on intervention to allow for replication	P Yes M
Sample size Primary outcome measure	44 subjects McGill Pain Questionnaire: self- reported, valid measure, reliable,	M P	65 subjects VAS: ● Self-reported	M P
Additional outcome measure	sensitive Oswestry Disability Questionnaire: self-reported, concurrent validity: unclear, reliable, sensitive	P	● Valid measure: yes, reliable: yes, sensitive: yes ROM: Independent (blinded) assessors not used ROM: validity, reliability, sensitivity: unclear, not described	F
Additional outcome measure	Range of motion: single independent assessor (blinded), valid measure, reliable, sensitive, intra-rater reliability	M	● No information on inter-rater and intra-rater reliability testing Patient perception of treatment effect: Self-administered: yes Validity, reliability, sensitivity of	F
Subjects starting and finishing	reported as 'good' 44 subjects randomized: immediate 42 subjects completed the treatment period (21 SEG and 21 CG)=95% 41 subjects completed 3-months follow-up (21 SEG and 20 CG)=93% 40 subjects completed 6-month follow- up (21 SEG and 19 CG)=90% 34 subjects completed full protocol (30 months) (19 SEG and 15 CG)=77%	P P P P (M)	measure: unclear 65 subjects randomized: immediate 56 finished treatment=86%	P P
External validity/ limitations	● Generalizability of results to those with isthmic spondylolysis and spondylolisthesis from 0 to 2nd degree 'slip' ● Reasons provided for loss to follow-up ● Control group treatments not standardized	Yes Yes Minor	● Reason not provided for loss for loss to follow-up ● Authors acknowledge limitations: small sample size	No
Statistical tests	TG showed a significant improvement at 30 months when compared to the CG	Yes	Significant improvement in pain in the extension treatment group (all translation categories)	Yes
Overall rating: Weak (any F) Moderate (No F; < 4 P) Strong (No F; 4+P)	F=0 M=3 P=8	Strong	F=3 M=3 P=4	Weak

Table 6. Comparative summary of studies meeting relevance criteria

Reference	Key features	Intervention	Outcome measures	Statistics	Authors conclusions	Comments
O'Sullivan et al. (1997) Location: Australia	RCT 44 subjects >3 months history of low-back pain 10-week intervention pre-post-test design with follow-up at 3, 6, 30 months Single independent assessor (blinded)	Randomized to one of: 1. Treatment group: Strengtheing of deep abdominal muscles with coactivation of lumbar multifidus 2. Control group: Treatment as recommended by medical practitioner	Pain: VAS Function: Oswestry ROM: cybex digital inclinometer Abdominal muscle recruitment: surface electromyography	TG showed a significant improvement at 30 months when compared to the CG Pain intensity: F=14.4, P<0.0006 Pain descriptors: F=6.1, P=0.0187 Oswestry disability: F=4.2, P<0.0481	Specific exercise to train trunk stabilizer musculature is effective to decrease pain, functional disability, reduce use of pain medication Exercise effective in long term: to 30 months	Study rated as weak initially until further information obtained from the author Exercise program lends itself to reproducibility within clinic setting Control group activities not standarized
Spratt et al. (1993) Location: United States	RCT 65 subjects Subacute and chronic low-back pain: 4 weeks to under 5 years 3 × 3 × 2 design ● 3 instability categories ● 3 treatments ● pre-post-test measures Three categories of instability 1. Retrodisplacement 2. Spondylolisthesis 3. Normal translation	Randomized to one of: 1. Flexion exercises and flexion brace* 2. Extension excercises and extension brace* 3. Control (sham treatment group)*	Pain: modified VAS ROM: Strength: Compliance monitored Patient perception of treatment effect	Pain: extension group showed improvement over time: F=11.61, P<0.03 Patient perception: flexion group reported low benefit from treatment, whereas extension group reported large benefit from brace and education components: F=3.65, P<0.04	Significant improvement in pain in the extension treatment group (all translation categories) Authors suggest that improvement found with extension treatment may indicate advanced disease of the disc as underlying pathology	Both spondylolytic and degenerative spondylolisthesis studied (one classification) Poor compliance with the flexion treatment especially in those with spondylolisthesis Inadequate sample for study design: low power

All groups received education on low-back care.

DISCUSSION

In this systematic review, few prospective studies were found that addressed the question of the efficacy of physiotherapy interventions in the treatment of low-back pain related to spondylolysis and spondy- lolisthesis. The strict criteria established for inclusion and exclusion criteria, as well as the requirement for a prospective study, eliminated many potential studies for review. The two studies that did meet our criteria were both randomized controlled trials and each study provided evidence of improvement in outcome measures from the physiotherapy intervention. A descriptive review of the two studies is provided in Table 6. O'Sullivan and colleagues provided evidence sup- porting the use of very specific exercise treatment regime for subjects with spondylolysis and spondylo- listhesis. The treatment group (TG) demonstrated statistically significant decreases in pain (both in intensity and in description) and functional disability when compared to the control group (CG). The results were effective in the short term (3 months) as well as the long term (30 months). A statistically significant difference was found within the CG following the treatment period for pain descriptors Spratt et al. (1993) examined the efficacy of flexion and extension treatments, incorporating braces for low-back pain, in patients with retrodisplacement, spondylolisthesis and normal sagittal translation. The study used a mixed-model repeated measures design with the three classification categories, three treat- ment groups (flexion, extension and control) and pre- test/post-test measures (3 × 3 × 2 design). The most important finding in this study was the reduction in pain in the extension treatment group. This finding occurred across all translation types and was significant. The primary concerns of the two studies identified by this review were as follows: (a) interventions/ control group activities were not well described; (b) the chosen outcome measure was not well described especially in terms of validity and reliability; (c) inadequate information was provided in regard to training of the individuals responsible for adminis- tering the outcome measures and (d) sample size The exercise description in the O'Sullivan study was well described and could be reproduced based on the published description; however, the control group activities were not clearly outlined or standardized. As the control group received many different, uncontrolled treatments, it is difficult to determine the actual effect of 'conservative treatment' on outcome. The exact treatment provided to the groups in the Spratt study was also not explained in detail. For example, though the flexion group received a flexion brace, flexion exercises and education on avoiding lordotic postures, detail was not provided on the type, intensity, frequency and duration of the exercise programme, nor on instructions for expected brace wearing-time. The control group was provided with a 'sham' brace and subjects were assigned to a physiotherapist. It is not clear if the control group received alternate forms of physiother- apy or if monitoring of control group activities was done.

The outcome measures utilized in the O'Sullivan study were: the McGill pain questionnaire, the Oswestry disability questionnaire, lumbar spine and hip sagittal range of motion (using a Cybex electronic digital inclinometer) and surface electro- myography of abdominal muscle recruitment pat- terns. An independent assessor administered the outcome measures. The same assessor was used at the pre- and post-10-week treatment period and self- rated mail-out questionnaires were used during the follow-up period of the study. The chosen outcome measures were not well described in terms of reliability, and of concern was the validity of the Oswestry. However, in communication with the author, testing for reliability and validity of measures was done and intra-rater reliability of the indepen- dent assessor was reported as 'good' (O'Sullivan, personal communication, 2000). In the Spratt study, outcome measures included range of motion, trunk strength, compliance to treatment, patient perception of treatment effective- ness and pain assessment using a visual analogue scale. The primary outcome measure was pain. A visual analogue scale was used, which is a valid and sensitive measure, and was well described in this study. The subject's assigned physiotherapist (who also provided the treatment) was responsible for measurement of range of motion and trunk strength. Information was not provided on the measurement methods or on the intra- and inter-rater reliability of the physiotherapists performing these measures. Independent assessors were not used but would have strengthened the study. As well, inadequate informa- tion was provided with respect to the questionnaire used to evaluate subject perception of treatment effect. The review findings also suggest that in future more attention should be given to the size of the study populations. In the two studies reviewed, information was not provided on how the sample size was predetermined. Specifically in the Spratt study, the final sample size of 56 subjects was inadequate for the study design. As well, there were only 19 subjects in total with spondylolisthesis and this classification included both degenerative and spondylolytic types. As there is limited knowledge of the aetiology of low-back pain related to spondylo- lysis and spondylolisthesis, a potential difficulty would be to obtain a homogeneous study population (Koes 1992). A larger sample size would provide more confidence that randomization of subjects had adequately controlled for known and unknown confounding factors (Koes 1992).

CONCLUSION

Systematic reviews in physiotherapy are used to assess the literature to determine the efficacy of treatment. In this review, very few prospective studies were found that examined the efficacy of physiother- apy on the topic area. The two studies undergoing critical appraisal were both initially rated as weak. Despite this, there is evidence suggesting that special trunk stabilizing exercises have a positive effect on low-back pain related to spondylolysis and spondy- lolisthesis. There was also evidence indicating that combined extension exercise, extension bracing and education are beneficial, though it is not possible to separate the individual effects of this combined programme. Future research is needed in examining the aetiology of the two conditions and the relationship between instability and presenting symptoms. This will hopefully allow for prevention, early detection and appropriate treatment. Specifically, in physio- therapy, randomized controlled trials are needed and should extend to examining the efficacy of treatment modalities. As well, to effectively study these condi- tions, treatment response should be evaluated with subjects of different ages and in different stages of 'slip' and therefore may necessitate multicentre trials. Increased exposure time and sports participation, among children and adolescents, have been corre- lated with an increase in reported low-back pain (Motley 1998). In present-day society, rising numbers are participating in the new acrobatic variations of snowboarding, cycling, skate boarding and roller blading. As the current sporting trend is likely to result in an increased number of individuals present- ing with spondylolysis and spondylolisthesis, further study is needed specifically within the young athletic population. It is also apparent from this review that authors of clinical trials need to publish study methods and results in enough detail to allow for analysis of scientific rigour. In conclusion, as the results of this systematic review are very limited, the field is wide open for further research in this area.

REFERENCES

Barash HL, Galante JO, Lambert CN, Ray RD 1970 Spondylo- listhesis and tight hamstrings. Journal of Bone and Joint Surgery 52-A(7): 1319–1328

Cherkin DC, Deyo RA, Battie M, Street J, Barlow W 1998 A

comparison of physical therapy, chiropractic manipulation, and provision of an educational booklet for the treatment of
patients with low back pain. New England Journal of Medicine 339(15): 1021–1029
de Vet HCW, de Bie RA, van der Heijden GJMG, Verhagen AP, Sijpkes P, Knipschild PG. 1997 Systematic reviews on the basis of methodological criteria. Physiotherapy 83(6): 284–289
Fellander-Tsai L, Micheli LJ 1998 Treatment of spondylolysis with external electrical stimulation and bracing in adolescent
athletes: A report of two cases. Clinical Journal of Sport Medicine 8(3): 232–234
eview. Journal of Quality Improvement 25(9): 470–479
Lonstein JE 1999 Spondylolisthesis in children. Spine 24(24): 2640–2648
Magee DJ 1982 Orthopaedics: Conditions, Assessment and Treatment, 4th edn, Volume I manual, Course Manual. University of Alberta
Magee DJ 1997 Orthopedic Physical Assessment, 3rd edn. W.B. Saunders Company, Philadelphia
Magee DJ 1998 Systematic Reviews (Meta-analysis) and
Functional Outcome Measures, Course Manual. University of Alberta
Magora A 1976 Conservative treatment in spondylolisthesis. Clinical Orthopaedics 117: 74–79
Motley G, Nyland J, Jacobs J, Caborn DNM 1998 The pars interarticularis stress reaction, spondylolysis and spondylo- listhesis progression. Journal of Athletic Training 33(4):
351–358
Newell RLM 1995 Historical perspective: Spondylolysis. Spine 20(17): 1950–1956
Osterman K, Schlenzka D, Poussa M, Seitsalo S, Virta L 1993
Isthmic spondylolisthesis in symptomatic and asymptomatic
subjects, epidemiology, and natural history with special
reference to disk abnormality and mode of treatment. Clinical Orthopaedics 297: 65–70
O'Sullivan PB, Twomey LT, Allison GT 1997 Evaluation of
specific stabilizing exercise in the treatment of chronic low back pain with radiologic diagnosis of spondylolysis or spondylo-
listhesis. Spine 22(24): 2959–2967
Portney LG, Watkins MP 2000 Foundations of Clinical Research Applications to Clinical Practice. Appleton and Lange, East
Norwalk, CT, p 167
Spratt KF, Weinstein JN, Lehmann TR, Woody J, Sayre H 1993 Efficacy of flexion and extension treatments incorporating
braces for low-back pain patients with retrodisplacement,
spondylolisthesis, or normal sagittal translation. Spine 18(13): 1839–1849
Stein F, Cutler SK 1996 Clinical Research in Allied Health and Special Education, 3rd edn. Singular Publishing Group, San Diego
Szapalski M, Gunzberg R, Pope M 1999 Lumbar Segmental Instability. Lippincott, Williams and Wilkins, Philadelphia
Warren S 1994 Research Theory in Rehabilitation. Rehabilitation Research Centre, Faculty of Rehabilitation Medicine,
University of Alberta

****