

Lumbar segmental instability: Manual assessment findings supported by radiological measurement (A case study)

John Freddy Behrsin
Frank John Andrews

Intervertebral instability is a condition which can potentially cause pain in the lumbar spine. This clinical paper considers a case study where a diagnosis of instability was made based on manipulative examination techniques and where this diagnosis was confirmed from lateral functional x-rays. This paper emphasises the importance of the examining therapist being on the look out for joint hypermobility as well as hypomobility in patients presenting with pain of spinal origin.

[Behrsin JF, Andrews FJ: Lumbar segmental instability: Manual assessment findings supported by radiological measurement (A case study). *Australian Journal of Physiotherapy* 37: 171-173, 1991]

Key words: Lumbosacral region; Backache; Radiography; Physical examination.

JF Behrsin, MSc, B App Sc (Phy), Grad Dip Manip Ther.

FJ Andrews, B App Sc (Phy).

Correspondence to: Wickham Road Spinal and Sports Physiotherapy, 214 Wickham Road, Moorabbin, Victoria, 3189.

One of the recognised causes of persistent low back pain which is often clinically overlooked is instability of the intervertebral joint (Friberg 1987, Grieve 1986, Schneider 1987). While there is ongoing disagreement over the definition of instability (Farfan and Gracovetsky 1984, Nachemson 1985, Paris 1985, White and Panjabi 1978), the authors consider instability to be excessive range of both physiological and translatory intervertebral movements which are the cause of symptoms. The mechanical causes for the presence of instability in the spine vary from bony injury, degenerative changes or injuries of the intervertebral disc as well as other causes such as ligament damage and structural anomalies (Farfan and Gracovetsky 1984, Kirkaldy-Willis 1983, White and Panjabi 1978).

While functional radiographic views can confirm the presence of segmental instability, good manual examination of patients should be able to confidentially indicate the presence of instability. There has been disagreement over the reliability of manual examination techniques (Gonella et al 1982, Matyas and Bach 1985, Matyas and Bach 1986, Stoelwinder et al 1986). This paper presents the clinical signs and symptoms of a patient with instability syndrome where manual examination

findings were confirmed by radiographic measurement of joint motion. This paper also emphasises the importance of detailed examination and the need to be on the look out for hypermobility as well as hypomobility in patients presenting with pain of spinal origin.

History

Mr M, a 24-year-old physical education teacher presented with a 10 year history of variable low back pain with a four year history of right posterior thigh and calf pain, worsening with time. Treatment in the past consisted of mobilisation and manipulation of the lumbar spine and mobilising exercises. These treatments had produced no significant improvement in his pain. Activities which aggravated his symptoms included those which involved lumbar spine extension (ie jogging, kicking a football, cricket bowling, prone lying and prolonged standing), while activities involving flexion (ie sitting, canoeing) were not as painful. In fact, a position of lumbar spine flexion, lying supine with knees to chest, eased his pain. He had occasional night pain, increased lumbar spine pain on coughing and, apart from a history of minor cervical spine pain, his general health was good.

From Page 171

Examination

On examination, lumbar flexion reproduced Mr M's back, buttock and thigh pain midway through range, pain increasing in intensity further in range, with full range being present. Lumbar extension reproduced sharp lumbar spine pain and slight right buttock pain, pain first being felt at 10 degrees, and the movement being limited by pain at 25 degrees (normal range being about 35 degrees). Right side flexion reproduced sharp lumbar spine pain and slight right buttock pain, range being 25 degrees (normal range being about 45 degrees). Left side flexion produced only slight central lumbar pain, range being 30 degrees. Examination into combined movements (Edwards 1986) indicated extension plus right side flexion to be the most painful position while the response into flexion was irregular, ie adding right side flexion and left side flexion to flexion both increased the pain.

Palpation revealed marked muscle spasm and pain on right unilateral postero-anterior movement (P-A) at the L4/5 level (Maitland 1986). It was also noted that lying prone for palpation reproduced Mr M's lumbar spine pain.

Passive physiological intervertebral movements testing (Maitland 1986) revealed hypermobility of extension at L4/5 while the A-P shunt test (Maitland 1986) indicated instability at L4/5 and reproduced Mr M's lumbar spine pain. This observation was made independently by the two authors.

The slump test (Maitland 1986) was restricted on the right side when compared to the left and reproduced Mr M's thigh pain.

Based on Mr M's history of variable aggravating factors, along with the manual examination findings of no significant limitation of range, local hypermobility on passive movement testing of L4/5 and some irregularity of combined movements, a clinical diagnosis of L4/5 instability was made as the major contributing factor for his symptoms.

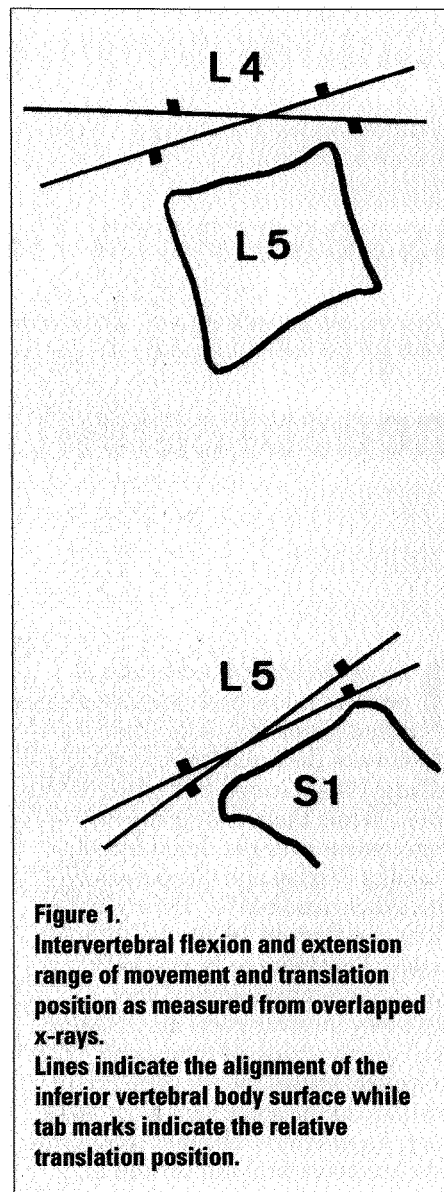


Figure 1. Intervertebral flexion and extension range of movement and translation position as measured from overlapped x-rays. Lines indicate the alignment of the inferior vertebral body surface while tab marks indicate the relative translation position.

Radiological findings

Plain x-rays were ordered to clear the presence of bony causes of the pain. Interestingly, the x-rays showed bilateral pars defects at the L5 level, resulting in a grade one L5/S1 spondylolisthesis.

As the main finding noted on the plain x-rays (ie L5/S1 spondylolisthesis) differed in level from the clinical diagnosis (L4/5 instability), and in consideration that the presence of spondylolisthesis in itself is not significant unless it is accompanied by instability (Friberg 1987, Macnab

1977), mobility x-rays were arranged to determine whether or not instability was present at L5/S1, the level of spondylolisthesis, and/or L4/5, the level of clinical instability.

Lateral view x-rays in full flexion and in full extension were taken (Figure 1) and the technique using overlapped tracings of the vertebrae taken from the x-rays described by Penning (1978) and Stokes and Frymoyer (1987) was adapted to measure inter-vertebral flexion/extension angular and horizontal translation ranges.

Angular movement during flexion/extension was measured to be 18 degrees at L4/5 and 10 degrees at L5/S1. Normal values for these joints are between 8 and 13 degrees (Allbrook 1957, Percy, Portek and Shepherd 1984, Taylor and Twomey 1980, Tencer et al 1982) indicating that the patient's L4/5 joint was hypermobile while L5/S1 had a normal range. Translatory movement during flexion/extension was measured to be 6mm for L4/5 and 2mm for L5/S1. Normal translatory range for these joints is 2mm, (Schultz et al 1979, Soni et al 1982) indicating some translatory instability at L4/5 and normal translation movements at L5/S1.

The overall results of the flexion/extension mobility and plain x-rays indicate that while there was a grade one spondylolisthesis detected at L5/S1 there was no instability at that joint. In contrast, L4/5, which appeared normal on plain x-ray was found to be hypermobile in flexion/extension and on postero-anterior translatory movement.

Clinical conclusion

Based on the clinical findings, which were confirmed by functional x-rays, it was determined that the patient's symptoms were a result of instability at the L4/5 joint. The appropriate approach to treating this type of problem would need to emphasise a combination of local erector spinae strengthening exercises combined with gross abdominal and extensor exercises, and training in active bracing of the spine using these muscles. Local recruitment of the lumbar extensors

during through range activities (similar to the Vastus Medialis Obliquus program of McConnell (1986) to the knee) should also be a part of treatment.

Local mobilisation/manipulation techniques, general mobilisation exercises or non-specific strengthening exercises would all be inappropriate, a fact which had been demonstrated by Mr M's poor response to these treatment approaches previously.

Summary of assessment observations leading to diagnosis

In summary, the clinical observation by which the diagnosis of instability was arrived at were:

1. Subjective finding of variable aggravating factors.
2. Chronic nature of the condition.
3. Pain, rather than stiffness, limiting active movement.
4. Irregular combined movements.
5. No hypomobility on palpation.
6. Hypermobility at L4/5 on passive physiological intervertebral movement.
7. Instability on shunt test at L4/5.

The patient's history (points 1 to 5 above) and active movement tests indicated that the condition was probably not due to a simple hypomobility problem. However, it was the findings of the passive movement tests for joint mobility and stability (points 6 and 7 above) which lead to the diagnosis of mechanical instability being made.

While the plain x-rays demonstrated an L5/S1 spondylolisthesis, the fact that instability had been clinically diagnosed led to functional x-rays being requested. These, in turn, supported the clinical diagnosis. If the initial assessment had not been thorough, the clinicians could have been led to think that spondylolisthesis at L5/S1, was the cause of symptoms which may have resulted in inappropriate and ineffective treatment.

Conclusion

This case study suggests that with thorough physiotherapeutic assessment accurate detection of instability in intervertebral joints can be made. Although it may be argued that the patient's history and active movement tests may indicate the possible presence of mechanical instability, this diagnosis can only be made if the passive movement tests are positive. This accurate diagnosis is essential for appropriate treatment to be planned and administered with confidence. This more thorough approach obviously compares favourably to the unsatisfactory "...there's a tender spot, let's push on it..."

Further research should be taken to compare the ability of therapists using manual assessment techniques to the radiological assessment to detect instability in the spine. It may be useful in future to research the ability of manual assessment tests alone (ie no history or active movement tests) to assess instability and compare this with radiological results. However, it should be remembered that in the clinical setting, therapists will always have access to history and active movement tests on which the direction of the rest of their examination will be based.

Acknowledgement

Miss Joanne Ely for her assistance in preparing this manuscript

References

- Allbrook P (1957): Movements of the lumbar spinal column. *Journal of Bone and Joint Surgery* 39B: 339-345.
- Edwards B (1986): Combined movements in the lumbar spine; their use in examination and treatment. In G Grieve (Ed.): *Modern Manual Therapy of the Vertebral Column*. Edinburgh: Churchill Livingstone.
- Farfan HF and Gracovetsky S (1984): The nature of Instability. *Spine* 9: 714-719.
- Friberg O (1987): Lumbar instability: A Dynamic approach by traction-compression radiography. *Spine* 12: 119-129.
- Gonella C, Paris S and Kutner M (1982): Reliability in evaluating passive intervertebral motion. *Physical Therapy* 62:437.
- Grieve G (1986): Lumbar instability. In G Grieve (Ed.): *Modern Manual Therapy of the Vertebral Column*. Edinburgh: Churchill Livingstone.
- Kirkaldy-Willis VH (1983): *Managing Low Back Pain*. New York: Churchill Livingstone.
- Macnab I (1977): *Backache*. Baltimore: Williams and Wilkins, pp. 44-63.
- Maitland G (1986): *Vertebral Manipulation*. (5th ed.) London: Butterworths.
- McConnell J (1986): The management of Chondromalacia Patellae: A long term solution. *Australian Journal of Physiotherapy* 32:215
- Matyas T and Bach T (1985) The reliability of selected techniques and clinical arthrometrics. *Australian Journal of Physiotherapy* 31: 175-199.
- Matyas T and Bach T (1986): Letter to the Editor. *Australian Journal of Physiotherapy* 32: 196-199.
- Nachemson A (1985): Lumbar spinal instability. *Spine* 9: 714-719.
- Paris S (1985): Physical signs of instability: *Spine* 10: 277-279
- Pearcy M, Portek I and Shepherd J (1984): Three dimensional X- ray analysis of normal movements in the lumbar spine. *Spine* 9: 294-297.
- Penning L (1978): Normal movement of the cervical spine. *Roentgenology* 130: 317-326.
- Schneider G (1987): Degenerative lumbar instability. In Proceedings of MTAA Fifth Biennial Conference. Melbourne, pp. 91-105.
- Schultz A, Warwick D, Berkson M and Nachemson A (1979): Mechanical properties of human lumbar spine motion segments, Part 1: Response in flexion, extension, lateral bending and torsion. *Joint Biomechanics Engineering* 101: 46-52.
- Stoelwinder E, Henderson G, Zito G, McCahéy P, Jull G, Johnston P, Trott P and McCormick G (1986): Letters to the Editor. *Australian Journal of Physiotherapy* 32: 194-195
- Stokes I and Frymoyer J (1987): Segmental motion and Instability. *Spine* 12: 688-691.
- Taylor J and Twomey L (1980): Sagittal and horizontal plane movement of the human vertebral column in cadavers and in the living. *Rheumatology and Rehabilitation* 19: 323-332.
- Tencer A, Ahmed A and Burke D (1982): Some static mechanical properties of the lumbar intervertebral joint, intact and injured. *Journal of Biomechanical Engineering* 104: 193-201.
- White A and Panjabi M (1978): *Clinical Biomechanics of the Spine*. Philadelphia: JB Lippincott