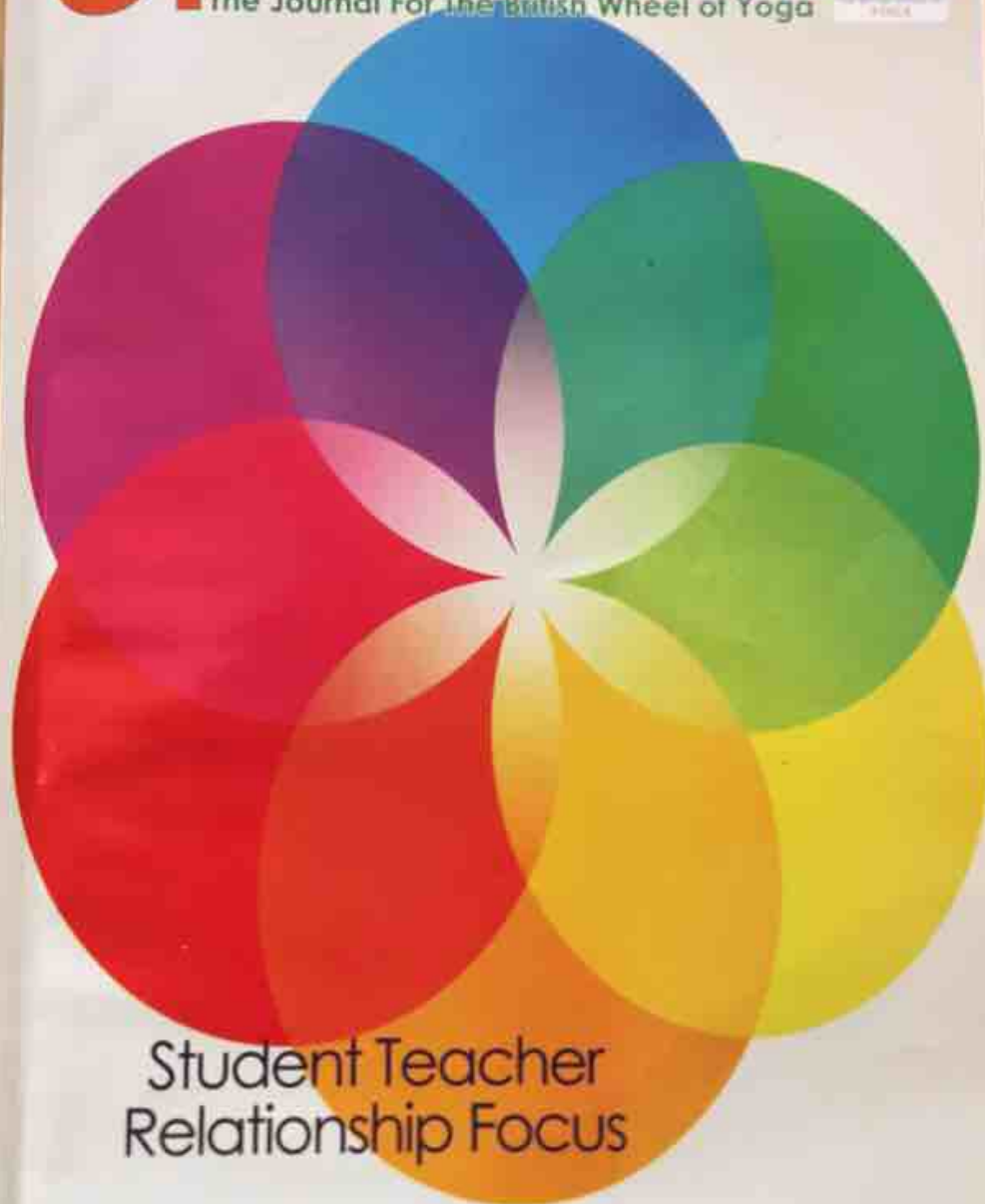


# Spectrum

The Journal For The British Wheel of Yoga

Spring 2009



Student Teacher  
Relationship Focus

# INSIGHT INTO RESEARCH:

## Respect your lumbar spine

by Tessa Sanderson

A lot of fantastic research happens in universities and hospitals across the world, yet it never seems to be communicated outside of academic journals. One area of research that is particularly interesting for practising yogis and important for yoga teachers to understand is anatomy. I recently found an article about lumbar spine and hip mobility that made me understand better why suppleness protects against back injury. It also made me consider how I might help students in my yoga class who have a history of back injury to prevent future episodes.

The lumbar spine (see Diagram 1) offers little resistance to bending over much of its range of movement. Your back muscles and ligaments act as brakes as you bend forwards, slowly lowering you forward or reeling you back up. The muscles and ligaments give your back stability and give precision to movements. Try to imagine a puppet that can flop forwards and then be pulled upright with strings. As you bend forwards, or flex your back, mechanical stresses are put on the spine. The stress put on the spine is called the bending moment. It rises rapidly as the limits of flexion and extension (bending backward in the case of the back) are approached.

Previous research has shown that people with supple spines have a larger range of movement with less stress affecting the

spine. For example, an extremely supple person can probably touch her toes without generating high bending stresses, whereas a very stiff person will be able to flex only a short distance before the stress on the spine rises to high levels and injury is more likely to occur. This has serious implications because bending beyond your limit is potentially harmful to the intervertebral discs and ligaments of the lumbar spine. This 'overloading' may lead to acute disc problems and back pain. This is not meant to scare you, but to make everyone realise the respect that the back requires!

### The study

The researchers wanted to prove whether people with poor mobility in the lumbar spine and hips put more stress on their spines in everyday lifting activities. Activities included: sitting down on the floor and then standing up, putting on a sock while seated, picking up a pen from the floor and lifting a variety of weights. All things that we are likely to take for granted unless we suffer from a back problem.

The 49 people who took part were told to perform the activities in a natural way. The measurements were taken using a system of electromagnetic waves (a gadget called 3-SPACE ISOTRAK) with one sensor placed over the lumbar spine (L1) and another over the sacrum (S1). The amount of flexion in different positions could then

be calculated from the readings of the monitor. The curvature in the erect standing position was taken to represent 'zero flexion' or the neutral position (see Diagram 2a). The participants were told to stand erect, but not to attention and to keep their line of sight level (similar to *tasaviana*). So it is important to think that a neutral standing position actually involves some natural extension (or bending backwards) of the lumbar spine. This is called lumbar lordosis and is critical for spinal health because it acts as a shock absorber as you walk.

The participants were mostly employed in light manual or office work. Sixteen of them had previously suffered from low back pain or sciatica that required medical attention. It was thought that previous back problems might affect the results so these were analysed separately. It could be that back problems may be more mobile because of instability in the spinal ligaments or be less mobile because of pain, whether felt or anticipated. There is also the possibility that people who have experienced back problems have learnt ways to move more safely, for example when picking up heavy objects.

To understand the true 'elastic' limits of bending in the spine, measurements were taken from cadaveric spines (yes, that's spines from dead bodies). Full flexion *in vivo* (or in a live person) does not bend the spine up to its elastic

limit (that would definitely hurt!) Instead, the term 'static' limit of bending is used.

Full flexion in this study was sitting on the floor (see Diagram 2b), with legs straight and bending forwards with a 'strenuous effort to touch the floor with their forehead'. This is similar to *paschimottasana*, although I would not give the instruction 'strenuous effort'. A backbend position, such as *bhujangasana*, was not included in the experiment. This is most likely because the research was focusing on flexion rather than extension.

Hip mobility was also assessed for each person. The sensor was attached to a vertical surface positioned close to the sacral (S1) sensor. The angle between the sensor was then measured with the person standing in 'straight-legged toe-touching position' or *uttanasana*. This measured overall hip mobility and hamstring tightness.

#### Results of study

In the group of participants with a history of lower back pain, lumbar mobility was reduced by about 7 degrees on average and hip mobility by 20 degrees compared to the 'no history' group. Hip mobility, as measured in this study, did not have such a strong effect on stressing the lumbar spine as spine mobility. However, in other studies poor hip mobility is associated with a greater severity of low back pain.<sup>1</sup>

During the exercises, all participants flattened or reversed their lumbar lordosis, even when lifting with the knees flexed. This is clear to see in a yoga class, but perhaps many people are not aware of how much bending actually occurs from the standing

position (with some extension of the lumbar spine) to move into a flexed position. The 'stiff' people in this study with low lumbar mobility flexed closer to (or further beyond) their limit of static range of flexion than the more supple people. This was true even during fairly innocuous tasks such as putting on socks or picking a pen up from the floor. So you do not need to be lifting a heavy weight to cause injury to your lower back. It might simply be that you reach too far and move beyond your range of flexion.

In this study, the bending 'moments' or stresses on the spine frequently rose to 40-50% of that required to cause damage in a single activity. This means that bending as well as compression might be responsible for discs and ligaments becoming injured. In other words, those who are less flexible are more at risk of stressing their spine through everyday activities and, over time, this continual stressing of the spine may cause injury (fatigue injury).

#### What does this all mean?

It could be argued that stiff people have shorter back muscles which do not permit them to bend as much as supple people do.<sup>1</sup> However, there is evidence that the limit of lumbar flexion is determined largely by the ligaments and discs rather than the muscles.

I think this challenges what a lot of yoga students believe. If people are aware that it might be their ligaments and discs, and not just their muscles, which are preventing them from bending forward as much as another person in the class, there might be less comparison with others. Greater care should be taken

in forward bends, particularly in 'unsupported' ones. For example, in *uttanasana*, a beginner may 'hang' from the lumbar spine if their hands are not supported, and they are not supporting from underneath with their abdominal muscles. This would place greater stress on their spine, particularly if they are straining to reach the floor or bouncing.

I think that all beginners in *uttanasana* should have their arms supported by a block or chair (if not reaching the floor) so that they are not placing stress on the lumbar spine at the limit of their flexion. The support can be taken away when the correct support from the abdominal muscles, particularly the *transversus abdominus*, is engaged.

The risk of injury to the lumbar spine is greater in the early morning when the discs are swollen with fluid and have an increased bending stiffness<sup>1</sup>.

This is not to say that yoga should not be practiced in the morning, but that more care is needed to move within a reduced range of flexion. For example, if you were to practice *uttanasana* in the morning, do not stretch as far as you would in the evening. Also, rapid movements and lifting heavy weights might increase the risks further. Make sure that you never 'bounce' as I see some beginners doing in classes because they think this will help them to move deeper into a posture. Lifting heavy weights is more commonly known as a risk for back injury. In yoga, one example of this could be lowering your legs to come out of *sinhasana* (see Diagram 2c). This movement creates flexion in the lumbar spine and the weight of the legs places additional stress on this area, particularly if the

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#### Glossary

Bhujangasana

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legs are straight. Therefore, you need to consider whether you or your student has the strength in the back and abdominal muscles, and the lumbar spine flexibility, to counterbalance this weight and prevent overloading the spine.

What I am suggesting is that we learn more about the structure of the spine and think more about finding our safe limits for flexion in the lumbar spine. Lumbar extension is a whole other story for a different day. And so is lumbar lateral (sideways) bending. And flexibility in general... Doing yoga with a knowledgeable teacher can re-establish the correct spinal posture, and encourages us to respect and protect our lumbar spine. Safe flexing everybody!

**Glossary**

- Bhujangasana - Cobra pose
- Extension - Bending of a joint (opposite direction to flexion)
- Flexion - Bending of a joint
- Intervertebral discs - Discs between vertebrae of spine
- Lumbar lordosis - Normal inward curvature of lumbar spine
- Pachimottasana - Seated forward bend
- Sirsasana - Headstand

Sciatica - Pain down sciatic nerve (usually across buttock, sometimes down leg)

Tadasana - Mountain pose

Trilokasana - Triangle pose

Uttanasana - Standing forward bend

Tessa is a BWV teacher in Bristol, specialising in pregnancy yoga. She is researching well-being in rheumatoid arthritis as part of a PhD and loves reading all kinds of research! She can be contacted at [tessa@damayoga.com](mailto:tessa@damayoga.com).

Special thanks to Patricia Dolan who told me about her interesting study at a research meeting. She is a senior lecturer at the Department of Anatomy.

**Endnotes**

- 1 Dolan, P. & Adams, M. (1993) "Influence of lumbar and hip mobility on the bending stresses acting on the lumbar spine." *Clinical Biomechanics*, 8: 185-192.
- 2 Mellin, G. (1988) Correlations of hip mobility with degree of back pain and lumbar spinal mobility in chronic low back pain patients. *Spine* 13: 668-70
- 3 Adams, M., Dolan, P., Hutton, W., Porter R. (1990) Diurnal variations in spinal mechanics and their clinical significance. *Journal of Bone and Joint Surgery*. 72-B: 266-70.



**Above:**  
**Diagram 1: Lateral (side) view of spine**

**Below:**  
**Diagram 2: Lumbar flexion measured by angle between lumbar spine (L1) and sacrum (S1): a) erect standing/tadasana (neutral); b) fully flexed/pachimottasana; c) moving out of sirasana with both legs straight. Parts a and b modified from reference 1.**

