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# EXPERT OPINION ON PUBLISHED ARTICLES

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Reviewer: Dr Nick Kruger  
Groote Schuur Hospital  
Cape Town  
Tel: (021) 404-5118  
Email: nicholas.kruger@uct.ac.za

## Comparison of thoracolumbosacral orthosis and no orthosis for the treatment of thoracolumbar burst fractures: interim analysis of a multicenter randomized clinical equivalence trial

Christopher S. Bailey, Marcel F. Dvorak, Kenneth C. Thomas, Michael C. Boyd, Scott Paquett, Brian K. Kwon, John France, Kevin R. Gurr, Stewart I. Bailey, Charles G. Fisher  
*J Neurosurg Spine* 2009;11:295–303

There is a large volume of literature published on the management of stable thoracolumbar burst fractures; however the ideal management of these common injuries remains debated. A variety of treatment options exist of which none have been shown to be superior. The default treatment was historically bed rest for several weeks followed by ambulant orthotic support. This has become less popular in recent times as prolonged recumbence has fallen from favour. Increasing cost burden, poor patient tolerance and clinician preference have resulted in earlier mobilisation with orthotics and earlier weaning out of the brace.

Our understanding of spinal stability in thoracolumbar fractures has evolved and the stable type fracture patterns are well described, giving confidence in earlier patient mobilisation. It is now known that there is no correlation between the duration of bed rest and degree of kyphotic progression after mobilisation during conservative treatment.

Some authors have questioned whether bracing is even required with stable fractures. Indeed, a retrospective study of 38 patients with 4-year follow-up in 1999 did not demonstrate any difference in outcome between bracing and no brace in stable thoracolumbar fractures.

This study specifically looked at clinical equivalence between orthosis and no orthosis and is of great interest, especially as many clinicians have questioned the efficacy of bracing at all.

This was a multicentre prospective randomised clinical equivalence trial in which the authors compared outcomes in thoracolumbar burst fractures treated with and without a thoracolumbosacral orthosis.

Patient inclusion criteria were AO Classification Type A3 burst fractures between T-11 and L-3, skeletal maturity up to age 60 years, admission within 72 hours of injury, initial kyphotic deformity <35°, and no neurological deficits.

The primary outcome measure was based on the Roland-Morris Disability Questionnaire assessed at 3 months post injury. Secondary outcomes included pain, functional outcome, health-related quality of life, sagittal alignment, length of hospital stay, and complications.

Patients with no brace were ambulated immediately following randomisation, maintaining 'neutral spinal alignment' for 8 weeks. Patients in the TLSO group were given bed rest until a brace was fitted, mobilised and weaned from the brace at 8 weeks over a 2-week period.

Sixty-nine patients were followed to 3 months and 47 were followed for up to 1 year. No significant difference was found between treatment groups for any outcome measure at any stage in the follow-up period. There were four failures requiring surgical intervention, three in the TLSO group and one in the non-TLSO group.

The authors concluded that there was equivalence between treatment with a TLSO and no orthosis for thoracolumbar AO Type A3 burst fractures.

The authors acknowledge that since the interim analysis was performed at the 50% recruitment mark, the sample size was relatively small and underpowered.

However this excellent, well-structured study does suggest that where there is an absence of posterior column injury in a thoracolumbar burst fracture, this injury is stable and abstaining from brace treatment is safe and equivalent to bracing.

Reviewer: Dr JH Davis  
 Consultant Orthopaedic and Spinal Surgeon  
 Tygerberg Academic Hospital  
 Cape Town

## Effectiveness of interspinous implant surgery in patients with intermittent neurogenic claudication: a systematic review and meta-analysis

Wouter A Moojen, Mark P Arts, Ronald HMA Bartels, Wilco CH Jacobs, Wilco C Peul

*Eur Spine J* 2011;20:1596–606

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This article aims to elucidate the indications for use of interspinous spacers through an analysis of the **better quality** literature available on the matter. An attempt is made to quantify effectiveness and highlight potential complications. The main objective is to evaluate whether surgeries with interspinous spacers demonstrate superior outcomes to bony decompression, or at least conservative treatment for intermittent neurogenic claudication secondary to lumbar spinal stenosis.

The authors performed a search of MEDLINE, EMBASE, Web of Science, Cochrane, CINAHL, Academic Search Premier and Science direct for available subject matter as published up to 1 July 2010. Reporting based on validated outcome scores (ZCQ – Zurich Claudication Questionnaire, Modified Roland Disability Questionnaire for Sciatica, Oswestry Disability Index, VAS – Visual Analogue Scale leg- and back pain), speaks to sound scientific principles, and was a prerequisite for inclusion.

The literature was categorised as: systematic reviews (validated through steps as outlined by Furlan and Van Tulder); randomised controlled trials (assessed for methodology quality through the Cochrane quality measurements adapted by Furlan and Van Tulder – high quality defined as 50% or more); and prospective cohort studies of high quality (methodological quality measured on the Dutch Cochrane Centre Quality Assessment scale – score < 6 defined as low quality). The authors ensure quality of the included material through this. Following quality assessment, only three randomised controlled trials and eight prospective cohorts were included from the initial 253 references. No systematic reviews could be found. This is unfortunate as it dramatically reduces the gravity of recommendations; this is however the best that is available to the scientific community.

Three reports described two randomised clinical trials (RCTs), with two of these studies describing the same patient sample after one- and two-year follow-up, respectively (Zucherman) (both with methodological scores of 5 – low quality). The other RCT included was of high quality with a score of 6 (Furlan and Van Tulder criteria) (Anderson *et al*). These reports all compared interspinous spacers to non-operative management.

Only one of the eight cohort studies had a methodological quality score of 6 (high quality); the rest were all considered to be of low quality with high risk for bias. One of the observational cohorts described two surgical cohorts with interspinous spacers following decompression versus decompression alone (Richter *et al*). The remaining seven cohorts looked at data of patients managed with

interspinous spacers only. No biomechanical evidence was included in this paper, and I refer the reader to a further article: *Lumbar Interspinous Spacers – A Systematic Review of Clinical and Biomechanical Evidence*. Syed M. R. Kabir, Sanjay R. Gupta, Adrian T. H. Casey. *Spine Volume 35, Number 25, pp E1499-E150*. This paper provides the interesting addition of biomechanical evidence, and was not included in the abovementioned article's data, as the date of publication (December 2010) fell outside the search parameters.

A total of 563 patients were treated with interspinous spacers in the mentioned studies. All studies showed improvement in validated outcome scores at six weeks and at one year. Pooled data from the RCTs supports the use of interspinous spacers over conservative management. **Interestingly the cohort description of patients with surgical decompression aided by interspinous spacers compared to the cohort with surgical decompression alone (no interspinous spacer) showed no statistical difference between the groups, with improved short- and long-term outcome scores in both cohorts (Richter *et al*).**

The overall interspinous spacer **complication rate of 7% includes 6% device failure** (n=31) requiring re-operation. This figure is fairly high, and might be under-reported in the relatively short follow-up period (one year). Six other complications were reported (1%) and included infection and 'post-operative leakages'.

This article concludes that the available body of literature shows decompression through interspinous spacers to be superior to conservative (non-surgical treatment) for patients with intermittent neurogenic claudication secondary to degenerative spinal stenosis. **The level of evidence however is debatable, and the term of follow-up was limited.**

There is no literature available comparing outcome in patients with interspinous spacers to surgical decompression alone.

Complication rates overall (7%) are comparable to surgical decompression but implant failures constitute 6% of the 7% reported complications. This is unacceptably high in my opinion.

Despite the meagre evidence available, interspinous spacers have seen a meteoric rise in use, often for various and unconfirmed indications. A large section of the available body of literature is industry-driven.

**This article highlights the lack of quality evidence in the use of and indications for interspinous spacers, as well as the long-term outcomes.**

Reviewer: Prof JA Shipley  
 Head: Department of Orthopaedic Surgery  
 National Hospital  
 Bloemfontein  
 Tel: 051 405-2242

***Spine* of 15 June 2011 has a number of articles on scoliosis surgery, and I thought it worthwhile to review a couple of them.**

## Maximal pulmonary recovery after spinal fusion for adolescent idiopathic scoliosis

K Verma, BS Lonner, KE Kean, LE Dean, A Valdevit  
*Spine* 2011;36(14):1086–95

Several factors influence the choice between anterior and posterior approaches for scoliosis correction in adolescents, both of which yield similar results. Reports of early, and sometimes long-term, reduction of pulmonary function are largely responsible for the present trend towards posterior correction and fusion, despite the increased blood loss and possibility of junctional kyphosis above a posterior fusion.

The authors reviewed 159 patients treated by a variety of operations by a single surgeon in a prospective 2-year study. Possible operations were posterior spinal fusion (PSF), anterior spinal fusion (ASF), video-assisted thoracoscopic release and instrumentation (VATS-I) or video-assisted thoracoscopic release and PSF (VATS-PSF).

The largest group was the 90 patients with main thoracic curves (Lenke 1), none of whom had ASF. The 22 patients treated by VATS-PSF had significantly larger curves, and all ASF patients had thoraco-lumbar or lumbar curves (Lenke 5). Taken together, these make correlation of respiratory function and surgical approach problematic but some reasonable conclusions may be drawn.

In Lenke 1 patients, PSF and VATS-I produced similar curve correction and improvement in SRS-22 scores.

In both VATS groups, respiratory functions were significantly reduced in the post-operative period, but resolved by 6 months except for FEV1, which remained slightly reduced at 2 years.

Recovery of pulmonary function was better after VATS-PSF than PSF or VATS-I.

The authors concluded that VATS procedures for thoracic curves, and open anterior approaches for thoraco-lumbar or lumbar curves, caused minimal to no permanent respiratory deficits compared to posterior surgery.

Despite the flaws in the study, and the absence of clear guidelines to the surgeon on which approach to use, this article shows that thoracoscopic surgery does have short-term but reversible effects on respiration, and can be useful in thoracic deformities. It also shows that anterior surgery is quite acceptable for Lenke 5 curves. The unresolved problem is whether anterior surgery is justified in main thoracic (Lenke 1) curves.

## Distal adding-on phenomenon in Lenke 1A scoliosis

Yu Wang, Cody Eric Bünger, Ebbe Stender Hansen, *et al.*  
*Spine* 2011;36(14):1113-22

Scoliosis correction surgery, like any operation, involves balancing the benefits against risks. A longer fusion may assure better correction but at the possible cost of unnecessary loss of mobility or function, and the increased risk of degeneration below the fusion. Too short a fusion may result in residual or recurrent deformity potentially requiring additional surgery – the so-called add-on effect. Selection of the distal fusion level is therefore critical to achieve the best compromise. Traditional guidelines such as fusing to two levels below the end vertebra (EV) (Harrington), the stable vertebra (SV) bisected by the central sacro-vertebral line (CSV)(King), or to the neutral vertebra (Moe), were developed before the modern powerful instrumentation systems were available, and are now of doubtful value.

To find the risk factors for adding on, and to determine the best lowest instrumented vertebra (LIV) in single thoracic

(Lenke 1A) scoliosis, the authors reviewed 45 patients treated by posterior segmental pedicle screw/rod constructs. Adding on was defined as progressive increase of the primary curve, with either an increase of 5 mm deviation from the CSVL, or more than 5° wedging of the disc below the lowest instrumented vertebra (LIV) at 1-year follow-up.

Of the 45 patients, 23 met the criteria for adding on. Risk factors identified were age; difference between SV or EV and LIV; and deviation of the vertebra below the planned lowest instrumented vertebra (LIV+1) from the CSVL. Analysis by a multiple logistic model showed that the single independent predictive factor for progression was an LIV+1 deviation of more than 10 mm from the CSVL ( $p=0.008$ ).

The authors recommend that in Lenke 1A curves, the fusion should extend down to the most cephalad vertebra deviating 10 mm from the central sacro-vertebral line.

Reviewer: Dr Richard PB von Bormann  
 University of Cape Town  
 Consultant Knee Surgeon  
 Department of Orthopaedic Surgery  
 Cape Town Sports & Orthopaedic Clinic  
 1. Christian Barnard Memorial Hospital, Cape Town  
 2. Blaauwberg Hospital, Blaauwberg  
 Email: drrichard@ctorth.com

## Glycosaminoglycan content of knee cartilage following posterior cruciate ligament rupture demonstrated by Delayed Gadolinium-Enhanced Magnetic Resonance Imaging of Cartilage (dGEMRIC): A case report

Allan A. Young, Peter Stanwell, Ashley Williams, James A. Rohrsheim, David A. Parker, Bruno Giuffre and Andrew M. Ellis  
*J Bone Joint Surg Am* 2005;**87**:2763-67

## The effect of irrigation solution at different temperatures on articular cartilage metabolism

Baris Kocaoglu, MD, James Martin, MD, PhD, Brian Wolf, MD, Mustafa Karahan, MD, and Annunziato Amendola, MD.  
*Arthroscopy: The Journal of Arthroscopic and Related Surgery* 2011;**27**(4)(April):526-31

### Concept: Are we protecting articular cartilage for long enough after surgery?

The natural history of the chondral pathology which results in post-traumatic osteoarthritis, following a closed joint injury, is not well understood or described. Any arthroscopic surgical event is in fact also a traumatic joint injury event and may play a role in post-traumatic osteoarthritis in the long term.

The first article by Young *et al.* gives a significant insight into the inflammatory response generated in articular cartilage following a closed joint injury. This study used delayed gadolinium-enhanced magnetic resonance imaging of cartilage (dGEMRIC). This provides an *in vivo* method for the assessment of the biochemical composition of articular cartilage and provides a surrogate measure of glycosaminoglycan content.

The study demonstrates that closed joint injury without bone bruising, articular or meniscal cartilage injury still produced a significant decrease in articular cartilage glycosaminoglycan content for a period of three to six months. Glycosaminoglycan loss from articular cartilage has been proven to have a significant impact on its biomechanical properties. The result is softer cartilage, making it susceptible to further chondral injury or accelerated wear during the recovery phase.

Every arthroscopic surgery produces a local inflammatory response within the associated joint. It follows that every arthroscopic surgery produces articular cartilage softening as a result of the natural inflammatory response. It will then take six months for the cartilage to return to its pre-injury status.

The second article, by Kocaoglu *et al.*, looked at the effect of arthroscopic irrigation solution temperature on articular cartilage chondrocyte metabolism.

Porcine cartilage explants were immersed either at 4 °C, at room temperature (24 °C), at normal knee temperature (32 °C) or at near-core body temperature (37 °C) All specimens were immersed for 2 hours. Lactate and proteoglycan production and RNA yield analyses were used to assess cartilage metabolism at different temperatures. Glycosaminoglycan content was measured.

The study showed that the short-term exposure to cold fluids, including room temperature, had detrimental effects on chondrocyte function. There was a statistically significant suppression of metabolism and a decrease in glycosaminoglycan content.

This study augments the results of the previous study to suggest that any inflammatory response of the articular cartilage reduces glycosaminoglycan content which results in articular cartilage softening.

These studies demonstrate the sensitivity of articular cartilage to insult, and the decrease in glycosaminoglycan content which results.

Hence:

1. Arthroscopic lavage fluid should be warmed to around 32°C.
2. After any joint injury which results in an effusion or any arthroscopic intervention it would be significantly beneficial to protect the involved joint for an extended period.

To what extent we need to protect the joint, whether it be bracing, immobilisation or decreased weight-bearing, is unclear. However these studies do seem to indicate that we should be limiting all impact sporting activities of the affected joint for a period of three to six months.

Reviewer: Prof J Walters  
 Dept of Orthopaedics  
 University of Cape Town  
 021 404-5118

### **'Personal Best' *Annals of Medicine*. *New Yorker* October 3 2011**

www.newyorker.com/reporting/2011/10/03/111003f  
 a-fact\_gawande

Although it is not usual to review articles from non-medical publications, this article conveys an important message to all surgeons, and is worth the read.

In his article entitled 'Personal Best' in the *New Yorker* October 3, 2011, Atul Gawande, airs the interesting and innovative concept of 'surgical coaching' throughout one's professional career, asking the question: 'Top athletes and singers have coaches – should you?'

He proceeds to present a rational argument for the continued need to practise surgery under the guidance of an independent and experienced practitioner to lend insight and objectivity to one's own surgical practice.

Gawande, who at 8 years post-specialist qualification, had come to the realisation that after an initial period of sustained improvement his own surgical skills and expertise had appeared to plateau.

His search for solutions for further improvement led his attention to fact that athletes had coaches, and in particular the top level, elite

sports and artistic performers all had personal performance coaches. If coaching was necessary for them to attain optimum performance, why is it not for surgery?

His own experience as a high level junior tennis player supported the notion that surgical skills could benefit from surgical coaching, as was apparent in other physical domains.

The essay provides illustrative surgical scenarios demonstrating the value of engagement with a learned observer who is well placed to make unbiased observational assessments of surgical skills.

With the passage of time and repetition we all lose the ability to judge objectively where improvements can be made or where we can better hone our surgical skills.

In a sense many surgeons do embrace this concept and personal experience has shown me the value of operating with a skilled and seasoned surgeon who can 'make suggestions' regarding easier access to the target site by improved exposure, alternative techniques or ergonomic use of equipment.

We are never too old to learn and as this article demonstrates, even the best still needs coaching.

It's a long read, but after page two it is well worth it.

This article raises the question that perhaps surgical coaching should become an integral part of modern-day surgical practice. In the interest of improved outcomes, perhaps yes.

Reviewer: Prof Mack Lukhele  
 Head of Department of Orthopaedic Surgery  
 University of the Witwatersrand  
 Johannesburg

### **Duration of Symptoms Relating from Lumbar Disc Herniation: Effect on treatment outcome. Analysis of the Spine Patient Outcome Research Trial (SPORT)**

Rihn Jeffrey A, Hilbrand Alen S, Radcliff K Kurd M, Lurie J, Weinstein JN

*J Bone Joint Surg Am*. 2011; **93**:1906-14

At some time during their lives 1-2% of the general population is affected by symptomatic lumbar disc herniation. In 70% of these patients the leg pain resolves within 6 weeks of presentation. The treatment option for symptomatic patients with more than 6 weeks of leg pain is non-surgical treatment in the form of education, counselling, anti-inflammatory medications, short-term narcotics and physical therapy with home exercise instruction or operative treatment - lumbar discectomy. Initial studies have shown that there is gradual improvement of pain and functional outcome in the symptomatic lumbar disc herniation patient treated surgically or non-surgically. Several studies conducted in the last 30 years including the Spine Patient Outcome Research Trial (SPORT) multicentre randomised and observational study have demonstrated the effectiveness of lumbar discectomy. Surgeons are often asked by patients how long they can postpone

surgical treatment before they compromise their potential for full recovery. This article presents a level 1 study by SPORT which sets out to prove the hypothesis that lumbar disc herniation patients with longer duration of pretreatment symptoms have a less favourable clinical outcome than those with a shorter duration of symptoms. The authors analysed 1192 patients enrolled in the study and found that patients who had symptoms for 6 months or less prior to receiving either surgical or non-surgical treatment had a greater increase in body pain and physical function domains of the Short Form-36 and a greater decrease in the Oswestry Disability Index score at follow-up intervals going up to 4 years compared with those who had had symptoms for more than 6 months before receiving treatment. These results demonstrated that patients who have symptoms for more than 6 months can find relief with either non-operative treatment or surgery but they may reap as much benefit as those who had symptoms for 6 months or less. There were some confounding variables limiting this study in that patients with more than 6 months tended to have depression, perceived the problem to be progressing and tended to opt for surgical treatment which may have biased the outcome of this study.

The study authors also found that operative treatment was significantly more effective than non-operative treatment in both groups of patients with less than 6 months symptoms and those with more.

These findings will help patients and doctors to make more informed treatment decisions on lumbar disc herniation.