The use of orthoses in lumbar spine fusion

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External back supports of all kinds have enjoyed great acceptance in the tradition of lumbar spine fusion. The desired orthotic function has been and still is to imitate fusion stiffness in the preoperative evaluation and to facilitate fusion healing. The use is based on the rationale that lumbar orthoses have a stabilizing effect on the spine facilitating fusion healing in line with the need for sufficient reduction of movements and loads during conventional fractur healing to avoid pseudarthrosis. The question is to what extent this assumed orthotic effect is correct? Potential evidence for orthotic effectiveness can be looked for in two types of scientific studies, clinical and biomechanical. A multitude of clinical studies have presented the use of lumbar orthoses from small soft corsets to actual plaster beds, but none has convincingly shown improved fusion healing due to orthotic use per se. Some biomechanical investigations, however, have illustrated in a scientifically acceptable way the importance of some modalities of lumbar spine loading and lumbar spine motion.

Spinal loading can be studied by measuring intradiscal pressure, intraabdominal pressure, myoelectric activity and gross body motion. The use of orthoses may have a directly unloading effect on the spine which has been demonstrated by measuring reduced intradiscal pressure using orthoses (10). However, any consistent indirectly unloading effect on the spine by altering the intraabdominal pressure (8) or myoelectric activity (6) has not been proven using orthoses. Gross body motion, i.e. overhang of the upper body at trunk flexion, extension and lateral bending, can be restricted using orthoses, which leads to decreased loading moments and thereby reduced load on the lumbar spine (5). The more rigid and extensive an orthosis is, the better is the limitation of gross body motion (5, 9), although the interindividual orthotic effectiveness varies (5).

Spinal motion can be separated into restriction of gross body motion described above and of actual intervertebral mobility. Radiography is the conventional method in studies of intervertebral mobility, despite the measurements are rather rough. The mobility has also been evaluated by pins inserted percutaneously into the spinous processes of lumbar vertebrae (7, 11) with results indicating small effects on intersegmental movements using braces. Roentgen stereophotogrammetric analysis (RSA) (12) is however the method of choice in studies of intervertebral mobility with high patient safety and measurement accuracy of 0.3 to 0.7 millimeter for 3-dimensional vertebral translations (3). RSA has demonstrated that neither a soft lumbosacral orthosis nor a rigid lumbosacral orthosis of TLSO type (9) has any consistent stabilizing effect on the intervertebral mobility in the supine and erect body positions (Table 1) (1). Not even adding unilateral hip immobilization to a rigid lumbosacral orthosis seems to significantly affect the intervertebral mobility according to preliminary RSA results (2). RSA has also demonstrated a rather considerable interindividual variation in lumbar intervertebral mobility both with and without orthosis (1, 2).

Thus, biomechanical studies have shown a directly unloading effect on the spine by using lumbar orthoses, as well as indirect unloading due to reduction of gross body motions. The intervertebral mobility, however, cannot be restricted by orthoses in the supine and erect body positions consistent with the postoperative situation after lumbar fusion. In addition, the interindividual variation in lumbar intervertebral mobility is considerable both with and without orthosis. These findings imply that patient characteristics

Table 1. Mean sagittal and vertical intervertebral translations (transverse translation negligible) between supine and erect body positions determined by RSA in patients without and with two different lumbar supports (1)

	Translation (mm)	
	sagittal	vertical
No orthosis	3.8	2.3
Rigid orthosis	4.7	2.7
Soft orthosis	5.0	2.7

including compliance to treatment might be more important than orthosis characteristics in lumbar immobilization.

The intervertebral translations begin to decrease 3 to 6 months after a successful uninstrumented posterolateral lumbosacral fusion (3). To yield an acceptable rate of fusion healing (80%), as defined by RSA, loads and movements of the lumbar spine should be kept at a minimum for at least 5 months postoperatively (4). This can be achieved by instructing the patients to avoid active and passive movements in the lumosacral spine with the aid of a comfortable lumbosacral orthosis of any type or material which both unloads the spine and reminds the patient of the postoperative regimen (4). By adding transpedicular internal fixation to lumbar fusion immediate intervertebral stabilization can be achieved, but it still seems logical with postoperative lumbar immobilization to avoid osteosynthetic insufficiency and pseudarthrosis. These immobilization principles should also be valid when trying to imitate fusion stiffness and to yield pain relief in the preoperative patient assessment .

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