Load-sharing through the anterior column is an important biomechanical factor which may directly affect fusion success and future disease progression following spine surgery. It has implications as to the longevity of implants, directly through screw loosening and breakage, and indirectly through altered biomechanics associated with stress shielding of that level. It has been postulated that semi-rigid or dynamic fixation provides more load-sharing in the anterior spinal column, a potentially advantageous benefit for both fusion and reduction of adjacent level stresses. In this study, the authors evaluated load-sharing of a novel posterior dynamic stabilization (PDS) system, TRANSITION®.

The regional load distribution on an interbody spacer was compared between rigid, semi-rigid PEEK, and semi-rigid dynamic posterior instrumentation (Figure 1). Load-sharing was quantified through a digital pressure film positioned on the spacer. The mechanical test fixtures, and instrumentation complex underwent simulated flexion of 12.8 Nm through three cycles of neutral-flexion-neutral. The pressure at maximum flexion of the last cycle was used for data analysis.

The force through the entire spacer was used to determine the percentage of anterior and posterior column loading as a fraction of the applied load. Load not passing through the pressure film (located in the anterior column) was considered to pass through the posterior instrumentation. The anterior column load-sharing was 55%, 59%, and 75%, for rigid rods, PEEK rods, and posterior dynamic stabilization, respectively. The posterior dynamic stabilization system transferred statistically more load to the anterior column than rigid or PEEK rods. Rigid and PEEK rods did not statistically differ in their ability to transfer load through the anterior column.
The load distribution across the interbody spacer area proved to be more uniform with posterior dynamic stabilization when compared to semi-rigid PEEK or rigid fixation as evidenced by Figure 2. Due to the predefined clearance of 400µm between the upper text block and sensing pad, load was first transmitted into the anterior portion of the spacer. With rigid and PEEK rods, minimal load was transferred to the posterior aspects of the spacer. Dynamic stabilization and rigid rods have similar pressures on the anterior region of the spacer, but differ dramatically in the posterior, left, and right portions of the spacer, which are much more uniform, and statistically higher for PDS when compared to rigid rods. One difference between the PDS device in this study and conventional designs is a cord imbedded within titanium spools which allow some travel or sliding to compress and engage the soft bumper. This effect may have helped to redistribute the loads.