Scoliosis is a medical condition where a person’s spine has an abnormal curve, resulting in difficulty of movement and pain. Occurring most often during the growth spurt just before puberty, an afflicted child’s spine can adopt a “C” or “S” curve that may get more severe over time. Current methods for treating scoliosis include surgery, casting, and bracing. Bracing is typically used when growth is still occurring and attempts to curb movement of the spine so that surgery is not necessary. The braces used today are variations of individually-fitted devices that are limited by their rigid nature. This technology introduces a dynamic brace that has force sensors and motorized structures to adapt to the user. The brace consists of 3 or 4 concentric rings connected either by mechanically driven pistons or a cable assembly. Data from pressure sensors located around the rings are sent to a small, portable computer which determines the force necessary to correct the spine. This self-adjusting brace may provide better treatment options with potentially minimal side effects for scoliosis patients.

Force sensors and flexible brace design help facilitate proper spine alignment

The design principle behind current spine braces is to provide pressure against specific areas of the torso to align the spine and promote normal growth in scoliosis patients. Since puberty is the most effective time to start using the brace, current fitted, non-adjustable braces have to be remade for individuals as they outgrow each personalized device. The rigid, plastic braces wrap around most of the torso, restricting daily activities and causing localized pain or skin irritation. Furthermore, the passive forces of these braces don’t provide perfect spine correction as the spine changes over time. This technology is an active brace with a flexible design that would not require the patient to get a new device during growth. The communication systems in this brace would restrict movement in directions to treat scoliosis, but allow movement for daily activities. Meanwhile, the less intrusive design of the brace may fit more comfortably on the patient. The force sensors on the brace may also provide real-time data to map patient progress over time for personalized treatments as well as clinical studies. Thus, this dynamic brace offers numerous advantages over currently used braces in the treatment of scoliosis.

Schematic and mathematical models for this dynamic brace have been designed and tested. A proof of concept model of this technology with a 3-ring brace structure has been constructed and tested for the degrees-of-freedom allowed and movement of the brace.
Lead Inventor:
Sunil K. Agrawal, Ph.D.

Applications:
- Advanced brace to treat spine curvature from scoliosis, kyphosis, or lordosis in adolescents
- Recovery for post-spine surgery patients
- Could be adapted for similar effects on different bones of the body after surgery
- Mapping patient progress for personalized treatment
- Motion tracking of spine for clinical studies on scoliosis
- Lumbar/spine support for heavy manual labor (movers, construction workers, etc.)

Advantages:
- Flexible design that allows movement for daily activities
- Lower-profile design is less intrusive and more comfortable
- Better real-time spine correction that is recalculated as the spine changes
- Sensors provide an extra dimension of data for monitoring of spine condition

Patent information:
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Related Publications:

Inventors
Sunil K. Agrawal