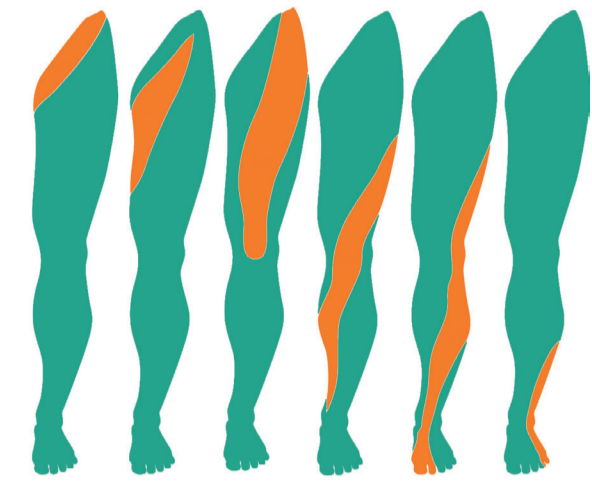


The ClearFix

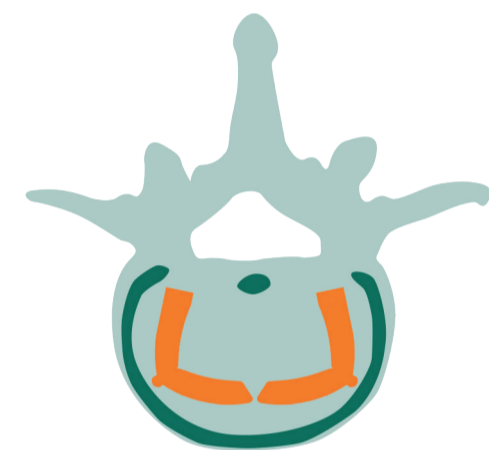
When someone is diagnosed with a hernia, the patient suffers from a failure of an intervertebral disc. Between every vertebra a pair of nerve roots exit the spinal canal, one to the left and one to the right. When exiting the spinal canal, these roots pass over a weak spot in the spinal disc. When the intervertebral disc herniates at this weak spot, the herniation can press against the exiting nerve root possibly causing leg pain in different areas of the leg. To treat these symptoms, a surgical procedure called an interbody fusion, may be performed.



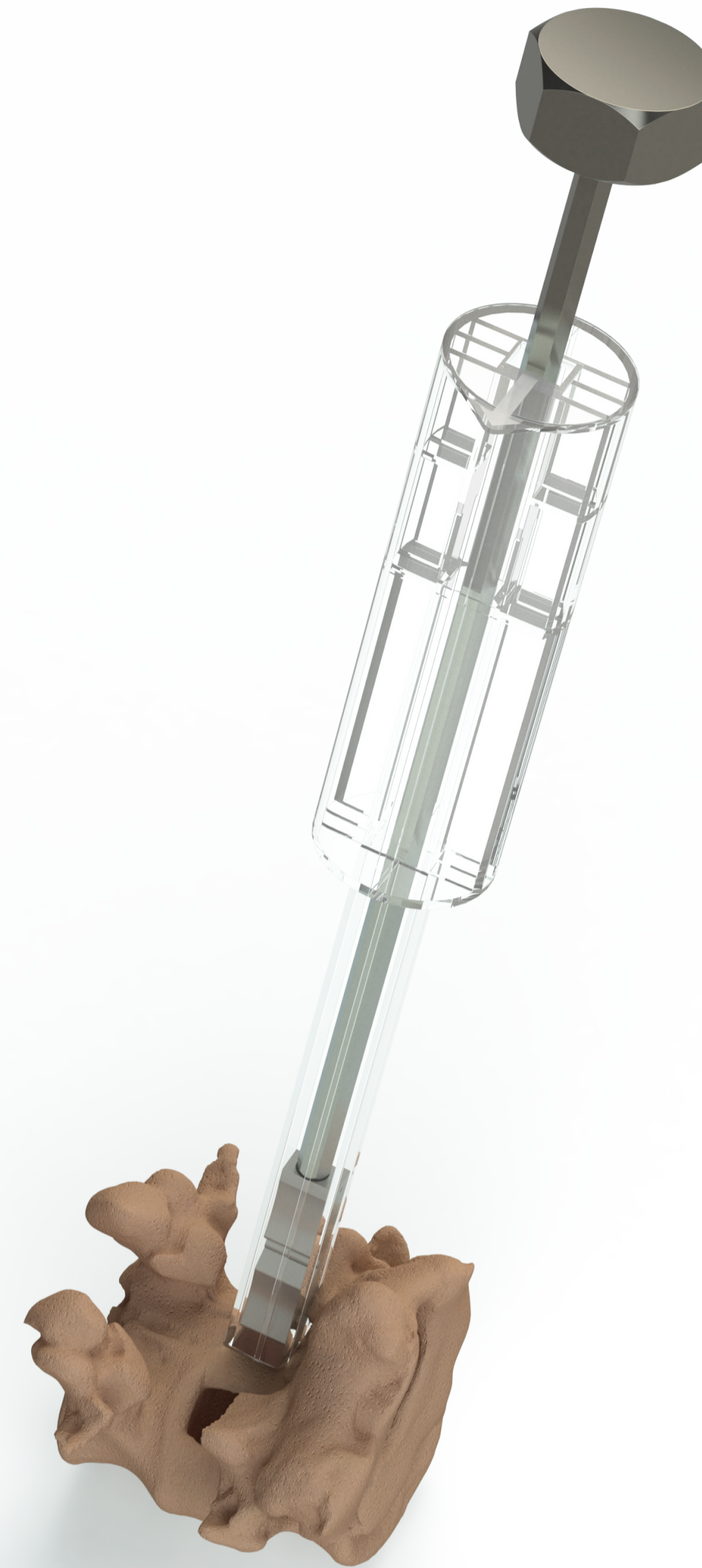
Hernia symptom areas

An interbody fusion operation is a surgical procedure where two or more vertebrae are fused together at the location of the intervertebral disc. This is done by removing the intervertebral disc and replacing it with one or more fusion implants (spinal cages) to maintain spine height and alignment, and bone graft.

Spinal cages are implanted with applicators. A researcher, working on a new spinal cage design, requires an instrument which is able to insert the new spinal cage. This resulted in this minimally invasive spinal cage applicator, the ClearFix. This applicator is designed with a low workload in mind. The workflow of a conventional applicator is cumbersome, especially for the scrub nurse who prepares the instrument before insertion. This is why the ClearFix comes with a cartridge containing the spinal cage. This cartridge can be easily inserted into the applicator, greatly reducing the time and workload needed to prepare the instrument. The instrument is made from clear polycarbonate to give the surgeon the best possible view on the small target in which the spinal cage needs to be inserted. Neurosurgeons stated that the ClearFix is quick to learn and intuitive to use, with a low workload. A low workload induces less stress and possibly reduces errors during the rest of the surgery.



Spinal cages (orange) positioned between two vertebrae. (Top view cross section)



The first step in using the ClearFix is to remove the instrument, and the cartridges with the spinal cages from the peel pouches and put them on the surgical instruments table.

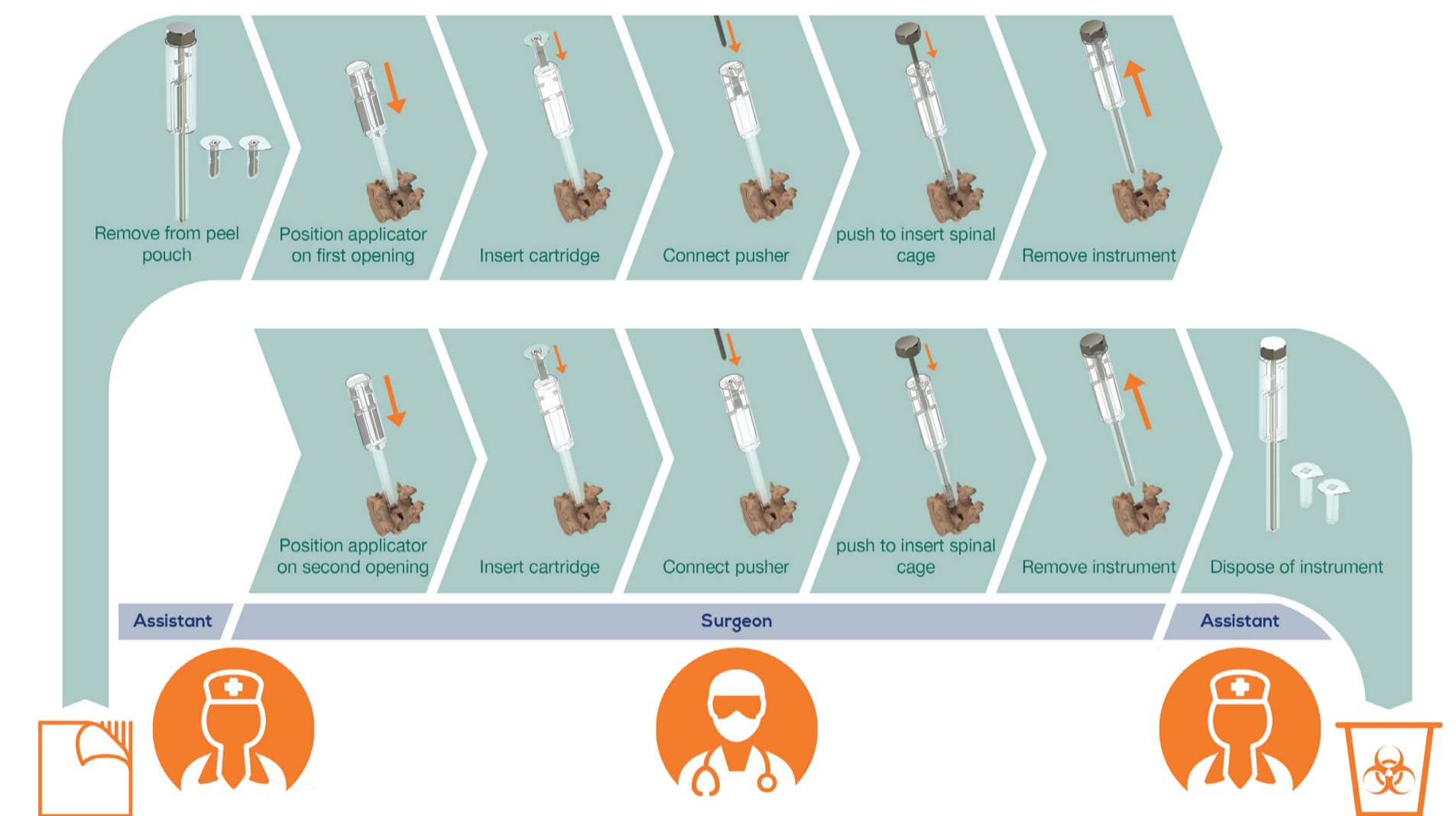
Next, the surgeon will place the applicator on the recently created opening in the intervertebral disc space. This creates a safe channel through which the spinal cage can be inserted without damaging any delicate anatomical structures like the nerve roots.

When the applicator is positioned as the surgeon sees fit, the cartridge containing the spinal cage is inserted into the applicator. The scrub nurse then hands the pusher to the surgeon who connects the pusher to the spinal cage.

The surgeon then proceeds to push the spinal cage down the shaft of the applicator. Then the cage enters the intervertebral disc space, the surgeon will use a mallet to hammer the spinal cage into place.

When the cage is inserted, the pusher is unscrewed from the spinal cage. The applicator and pusher are then removed from the patient's body. The second spinal cage is then inserted following the same steps.

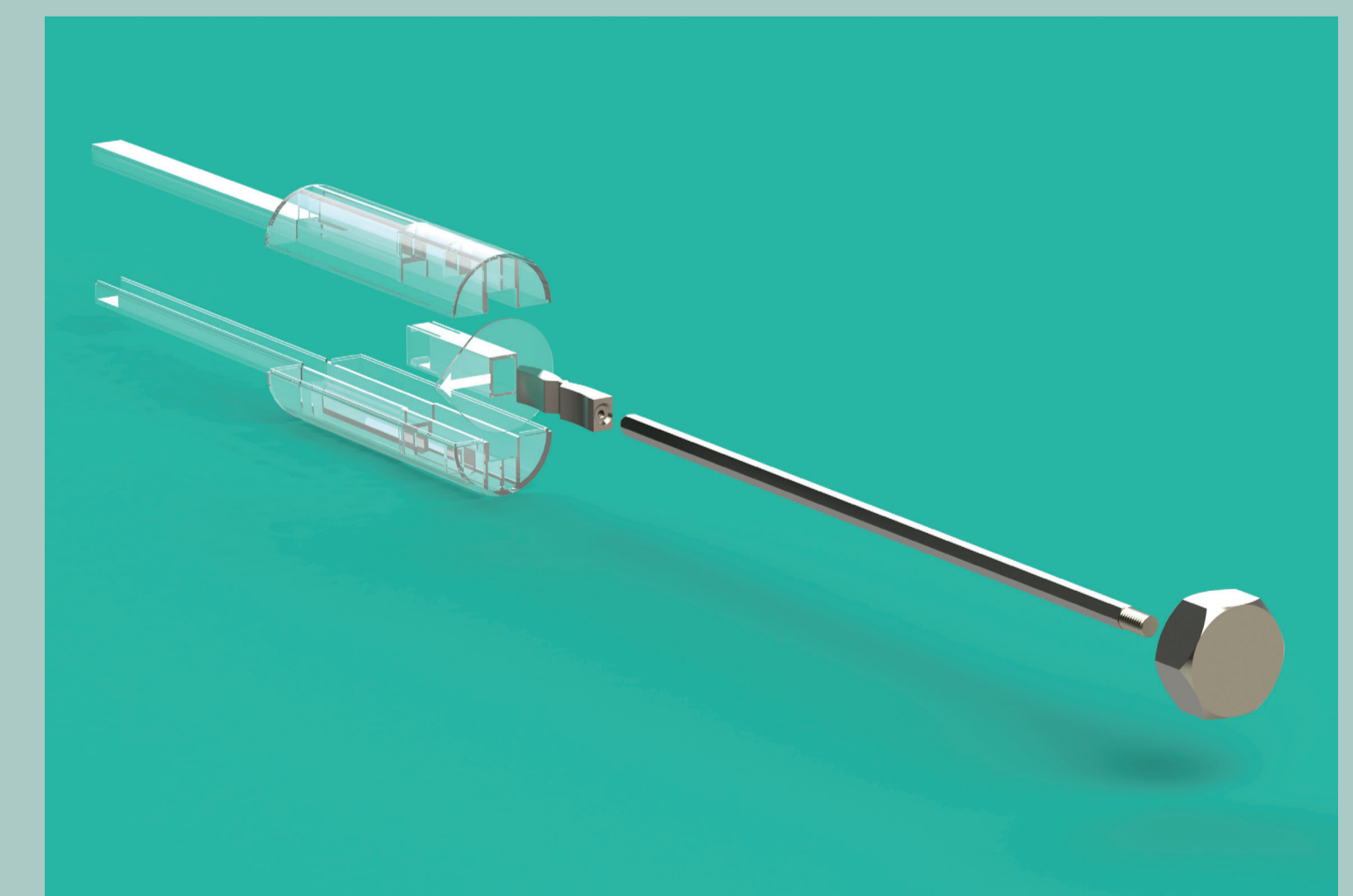
After the surgery, the applicator, pusher and cartridges are disposed of with the other disposable instruments.



ClearFix workflow



DESIGN OF A MINIMALLY INVASIVE SPINAL CAGE APPLICATOR



M.F. Hoedemaker
Design of a minimally invasive spinal cage applicator
November 17th, 2017
Integrated Product Design (Medisign)

Committee Prof.dr.ir. R.H.M. Goossens
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