Steel Wars: The Surface Strikes Back

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Introduction

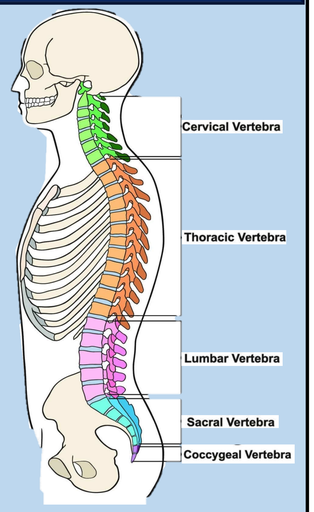
Stainless Steel Spinal Retractors:

•Surgical device that holds tissue and muscle out of the way during spinal surgeries.

•Minimizes internal tissue damage while creating a working space for the surgeon.

•Used in Thoracic and Lumbar spine surgeries.

Spinal retractor device



Vertebral column

Problem

Biocompatibility Surface Concerns

•Stainless-steel spinal retractors caused infections in patients.

•The retractors displayed strange markings and visible pitting on the surfaces.

Infection Risk in Spine Surgery

•Corrosion creates tiny cracks and pits, which are difficult to sterilize. This introduces an infection risk due to the generation of bio-films.

•Spinal infections can lead to prolonged recovery, disability, or paralysis.

Solution

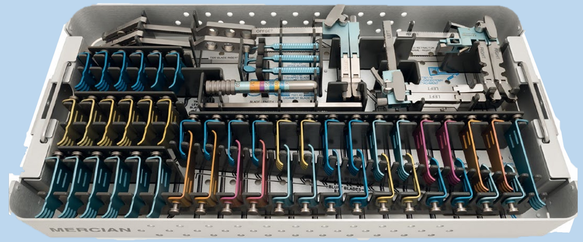
Discussion

•Consistent use and sterilization caused the retractors to wear over time.

•Cast Stainless Steel is a vulnerable material that introduces risk to patients.

Recommended Solutions

•Substitute anodized aluminum / titanium for the cast stainless steel.



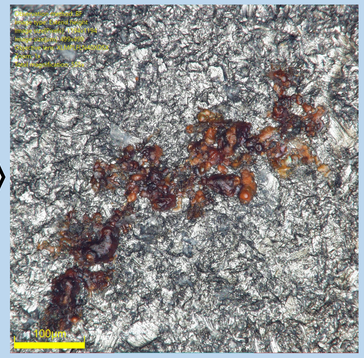
Merican titanium spinal blade retractor set

Methods / Results

Macro-Photography | **Digital Optical Microscopy** | **Laser Confocal Microscopy**

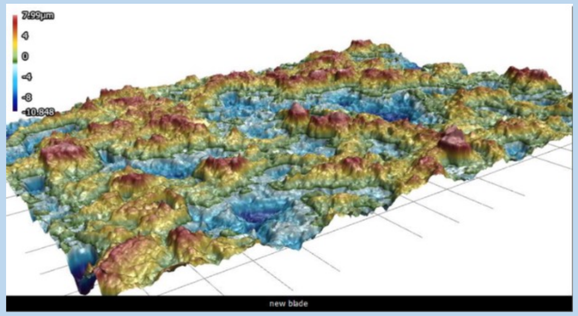
New Retractors

Unused spinal retractor blades



Corrosion ~400 μm long

Pitting ~79 μm in depth.

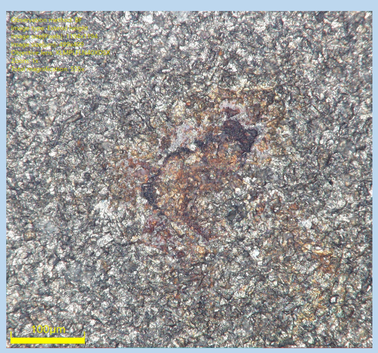


Surface topography of unused blade

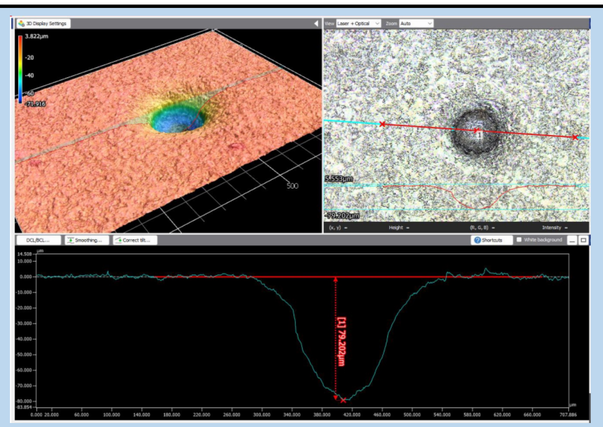
Used Hooks / Retractors

Used spinal retractor blades

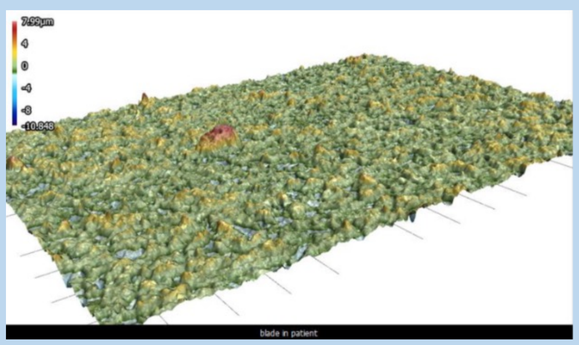
"Cloudy" bio-film in pit



Corrosion ~150 μm long



Depth profile of circular pit - 9.2μm in depth



Surface topography of used spinal retractor blade

Results

•All retractors have large sections of corrosion and pitting.

•Analysis shows that the pits were caused by a combination of sand blasting and corrosion.

•New retractors have more surface topography than the used retractors, indicating that the retractors are susceptible to corrosion and wear.