Session 1 | Whitecloud Award Nominated Papers

3. A Novel Growth Guidance System: Research and Development †
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Hypothesis
A Novel Growth Guidance System can reduce metal debris and decrease sliding friction.

Design
In vitro and in vivo experiments.

Introduction
Our study team developed a novel growth guidance system. Two major modifications were made to the traditional Shilla system, including the use of ultra-high molecular weight polyethylene (UHMWPE) gaskets to avoid direct contact between the screw and rod, and polishing the surface of sliding part of the rod.

Methods
The fatigue test and the displacement test were conducted. The maximum sliding displacement of the system was measured after a 300 cycles of dynamic compressive loads in a sinusoidal waveform. The in vivo experiments were also conducted by implant the system in miniature pigs. X-rays, CT scan and MRI were taken to assess the ability of spinal growth preservation. Blood metal ion concentrations and histological examination were conducted to assess the metal debris reaction and histo-compatibility.

Results
After the fatigue test, all the UHMWPE gaskets samples showed some of the fretting on the edge, but still isolated and avoided the friction between the screws and rods. No sign of metallic fretting around the screws and rods. The average wear mass of the gaskets was 0.002 ± 0.001g, less than 1.7% of the original mass. In the sliding test, the novel growth guidance system demonstrated the best sliding capacity, with an average maximum sliding distance (AMSD) of 35.75 ± 5.73mm, significantly better than the traditional Shilla implants. Six miniature pigs underwent surgeries, with an immediate postoperative mean spinal fixation length of 20.1 ± 0.7cm and 23.5 ± 0.7cm at 12 weeks postoperatively. CT and MRI scans showed no signs of degeneration of the facet joints or discs in the instrumented spine. There were no significant changes in titanium concentrations. Gross anatomy revealed no metal debris around the sliding screws. Histological reaction scoring indicated that the tissue response to the implantation of the novel sliding screws was either non-irritating or mildly irritating.

Conclusion
The novel growth guidance system demonstrated excellent wear resistance and sliding performance in vitro. In vivo experiments revealed sliding capabilities of the system, preserving spinal growth potential while causing no damage or degeneration to intervertebral discs and facet joints. The system also exhibited no irritation to local soft tissues and displayed favorable biocompatibility.

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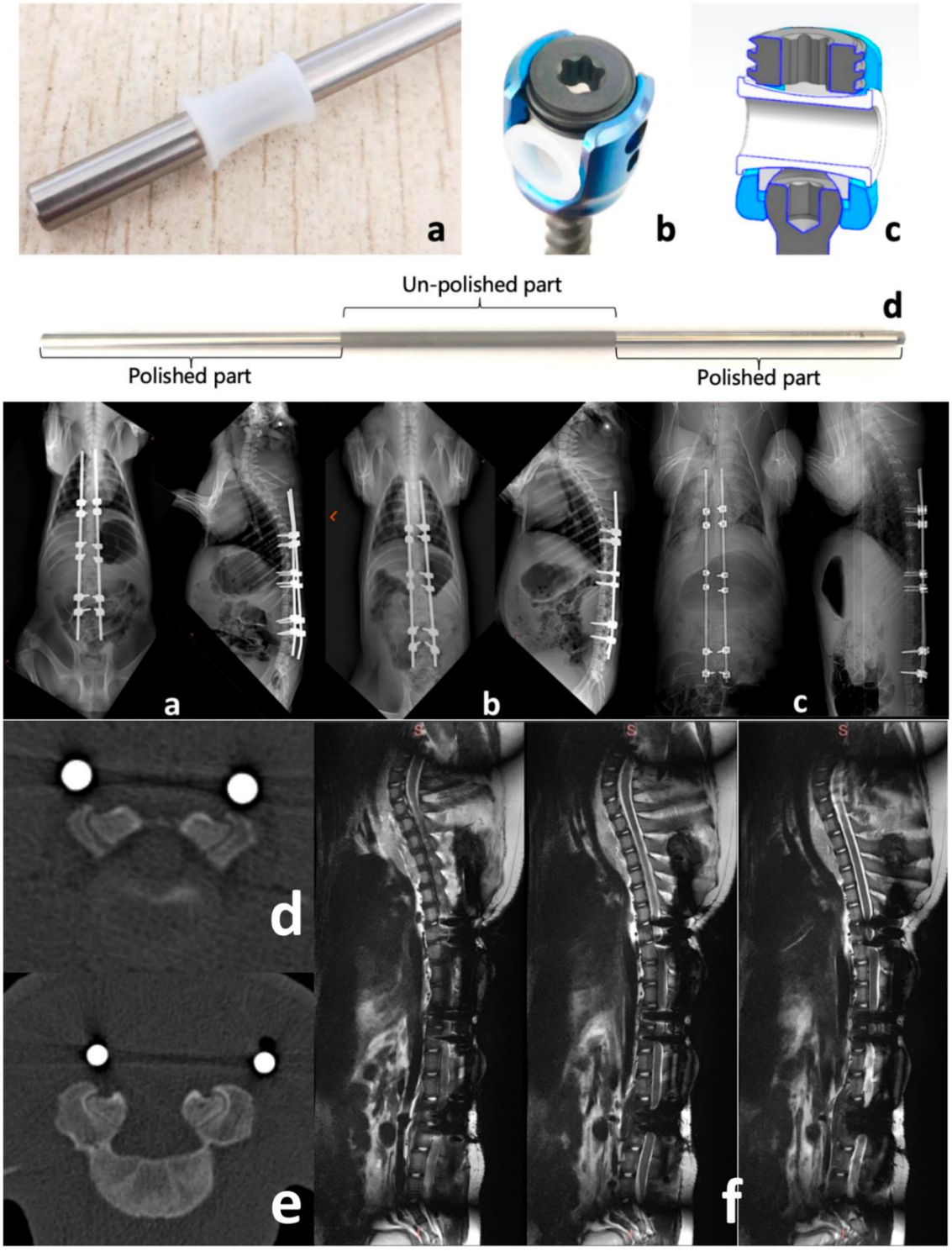

A novel growth guidance system

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