In Vivo Degradation of a Novel Poly(ε-Caprolactone) Invertebral Cage for Anterior Cervical Discectomy and Fusion in a Porcine Model

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Introduction
Anterior cervical discectomy and fusion (ACDF) is a common treatment for radiculopathy, spondylolisthesis, and trauma. An alternative is needed to current non-degradable structural cage materials (titanium, PEEK) for vertebral body fusions. We have previously shown that porous poly(ε-caprolactone) (PCL) cages can withstand surgical impaction and in vivo spinal forces, while supporting bone ingrowth required for spinal fusion2. The objective of this study was to investigate the in vivo PCL degradation that occurred in these implants.

Materials and Methods
Implant designs were created using image-based methods1 and manufactured from PCL (CAPA 6501, Solvay Caprolactones) via Selective Laser Sintering2 (Sinterstation 2000™, 3D Systems). To enhance bone growth, cages were then either mineral coated or filled with collagen/BMP-7 (ProSpec-Tany TechnoGene)2. An ACDF procedure was performed on 6-8 month old Yucatan mini-pigs (n=13) at the C5-C6 level. After sacrifice at 6, 12, or 18 months, the PCL from each fusion was dissolved in THF and subjected to GPC analysis to determine the weight average molar mass (Mw) and polydispersity of the polymer chains.

Results
The results for Mw and Polydispersity at 6, 12, and 18 months (N=7,3,3, respectively) were combined for each experimental group (Fig. 1). The Mw decreased significantly over time in vivo (P<0.05), and relative to the raw PCL or post-manufactured PCL, while polydispersity did not change significantly. At 6, 12, and 18 months in vivo, Mw values decreased to 93, 75, and 62% relative to post-sls pre-implantation Mw.

Discussion and Conclusions
Our in vivo PCL results of gradual and late Mw decreases that are compatible with bone regeneration are consistent with the literature3,4.

References

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