Novel Biomimetic Delivery System of Adipose-Derived Stem Cells and Platelet-Derived Growth Factor with Osteoinductive Bone Particles in Biodegradable Grafts Displays Successful Posterolateral Lumbar Spinal Fusion

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Tissue-engineering and Spinal Fusion

- Platelet-derived growth factor-BB (PDGF) is proposed as an attractive alternative growth factor to BMP-2, since it directly promotes the osteogenesis of ADSCs when applied at physiological concentrations.

- **Aim:** Evaluate the efficacy of a novel biomimetic delivery system—that promotes **sustained binding of PDGF to decellularized bone matrix** (HC-DCB) in ADSC-seeded **biodegradable polycaprolactone (PCL)-fibrin grafts**—in achieving successful spinal fusion in a rat model.
Methods

Study Design

- Cultured-expanded ADSCs (P2)
- 20 μg/dL PDGF-BB
- PCL-DCB scaffold + HC-DCB particles (40 mg/mL in fibrin)

Fusion Assessment

8 weeks after surgery

- [1] PCL only (Control 1)
- [2] PCL-DCB + HC-DCB particles (Control 2)
- [3] PCL-DCB + HC-DCB particles + PDGF
- [4] PCL-DCB + HC-DCB particles + 2.5x10^6 ASCP2/side
- [5] PCL-DCB + HC-DCB particles + 2.5x10^6 ASCP2/side + PDGF
Results

• Fusion was reached in all treated groups \([3,4,5]\), achieving maximum CT fusion and manual palpation scores.

• No statistical differences in new bone volume were found between treated groups \((p>0.05)\), which was higher than in control groups \([1,2]\) \((p<0.05)\).
Results

- Histological staining demonstrated that the groups with PCL-DCB grafts were well-integrated with the host transverse processes, showing expression of CD31, Osteocalcin and RUNX2 in these groups.
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Conclusions

• Biodegradable PCL-DCB grafts enabled spinal fusion when combined with osteoinductive HC-DCB particles.

• Although presence of both cells and growth factors was not required to achieve spinal fusion in combined PCL-DCB + HC-DCB grafts, ADSCs and PDGF-BB enhanced bone formation.

• Ongoing immunohistochemistry is currently being performed in order to characterize cell population within the fusion masses.
Thanks