Bone Tissue Engineering by Bioreactor
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Hydrodynamic Bioreactor
Seeding, viability, function
Cells
Nutrient → O2
Safety, cost, convenient, evaluation prior transplantation
Clinical Application
Purpose
Oscillatory flow
→ Loading induced flow profile in vivo
Develop a hydrodynamic bioreactor:
Compact
Safe
Easy operation
In-line seeding with high efficiency
Small culture volume ↔ large culture volume

Methods of Seeding and Culture
β-TCP Scaffold
(10mm × 10mm)
MC 3T3-E1 Osteoblast-like cells
1.5 × 10^5 / 100µl
β-TCP scaffold:
Top Dropping
DNA Content
ALP Activity
MTT Staining
Hoechst/PI Staining

Oscillatory perfusion system:
Q: what new?
3D culture sys.
Seeding
University
University
Volume
Culture
Scaffold
Efficiency, cost
Safety, viability function
Cells
Adaptation
Nutrient → Oscillatory Perfusion
Proliferation/Culture
Volume
ALP Activity
Scaffold
DNA Content
ALP Staining
Compaction
Efficiency, cost
Safety, viability function
Cells
Adaptation
Nutrient → Oscillatory Perfusion
Proliferation/Culture
Volume
ALP Activity
Scaffold
DNA Content
ALP Staining
Compaction

Evaluation of Flow Rate
Waveform
The difference in flow rate among the 6 waves: 5.81%-5.6%
(n=3)

Conclusion
Tissue engineering bone with clinical relevant size could be cultured uniformly in only 1.5ml media by the oscillatory perfusion system.

Oscillatory perfusion system:
Compact, efficient seeding & culture, safe, etc.
The only bioreactor → uniform 3D culture
0.5ml/min → optimized
Cassette design → internal flow + external flow
Strategy of 3D culture of customized tissue engineering bone was established - first study