The effects of rhBMP-2 injection at distraction osteogenesis of rats’ tibia

Hae-Ryong Song¹,², Hyo-Geun Kim¹,², Sung Eun Kim², Young-Pil Yun², Ji-Hoon Bae², Hak Jun Kim²*

¹ Division of Brain Korea 21 Program for Biomedical Science, and ²Department of Orthopedic Surgery, Korea University, College of Medicine, Seoul, Korea
The effects of rhBMP–2 injection at distraction osteogenesis of rats’ tibia

Hak Jun Kim, M.D.

My disclosure is in the Final AOFAS Program Book. I have no potential conflicts with this presentation.
Technique of enhanced bone consolidation

- Auto bone graft
- Allograft
- Hormonal Therapy - Parathyroid Hormone
- Vitamin D3
- Bisphosphonate
- Calcium sulfate
- Demineralized bone matrix (DBM)
- Cell therapy - bone marrow derived cell
- Low intense pulsed ultrasound
- Electric stimulation
- BMP-2 have strongest osteoinduction power
Study Design

- 18 Sprague–Dawley rat, 250~300g
- Bilateral external fixators on tibia
- Latency period: 7 days
- Distraction rate:
  0.25mm X 2 times X 10 days (total 5 mm)
- BMP-2(Cowellmedi®, 0.1mg/ml) injected at final lengthening
- Treatment group
  Control group: 15 animals
  BMP inj. group: 15 animals
Evaluation

- Sacrifice at time point 2 week, 4 week, 8 week after rhBMP-2 injection
- Pixel value at simple radiography (ImageJ® program)
- Histological evaluation
- Micro-CT evaluation
Results

Control group

BMP-2 group
## %Pixel count by ImageJ

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>BMP</th>
<th>P-value</th>
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<tbody>
<tr>
<td>2w</td>
<td>77.9±8.4</td>
<td>82.3±14.9</td>
<td>0.149</td>
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<tr>
<td>4w</td>
<td>80.8±2.3</td>
<td>101.2±8.4</td>
<td>0.034</td>
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<tr>
<td>8w</td>
<td>84.0±9.1</td>
<td>102.5±11.2</td>
<td>0.034</td>
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</table>
% Bone volume from MicroCT

<table>
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<th></th>
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<th>8w</th>
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<tbody>
<tr>
<td>Control</td>
<td>23.08</td>
<td>37.96</td>
<td>47.56</td>
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<tr>
<td>BMP-2 inj</td>
<td>36.16</td>
<td>40.26</td>
<td>2.5</td>
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Trabecular Separation from MicroCT

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<tbody>
<tr>
<td>Control</td>
<td>1.89</td>
<td>1.79</td>
<td>1.89</td>
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<tr>
<td>BMP-2 inj</td>
<td>2.14</td>
<td>2.34</td>
<td>2.24</td>
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</table>
Histological evaluation (2w)

Control group

BMP-2 group

Histological evaluation (8w)

Control group

BMP-2 group
Summary

✔ Bone consolidation of percentage pixel count was higher in the experimental group at 2, 4, 8 week, and statistically significant higher than the control group at 8 weeks ($p < 0.05$).

✔ Percentage bone Volume, trabecular thickness in the experimental group was higher than the control group by evaluation with micro-CT.

✔ Histological examinations,
  
  Intramembranous ossification was seen at 2 week-specimens in the experimental group.
  
  Intramembranous and enchondral ossification was seen in the experimental at the 4 week-specimens.
  
  Trabeculae thickness in the experimental group was thicker than the control group at 8-week specimens.
Conclusion

rhBMP-2 injection promoted bone consolidation of distraction osteogenesis at early stage from our study