Effect of Strontium Citrate on Bone Consolidation During Mandibular Distraction Osteogenesis

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Introduction

- Distraction osteogenesis is a surgical procedure used in craniofacial surgery to alleviate upper airway obstruction.
- Preformed by making an osteotomy and gradually distracting the bone, allowing new bone formation
- Prolonged healing phase increases risk of complications
- Strontium Citrate has been shown to improve bone formation in osteoporotic patients
- **Objective: Assess the effect of Strontium Citrate on bone healing in distraction osteogenesis in a rabbit model**

Methods

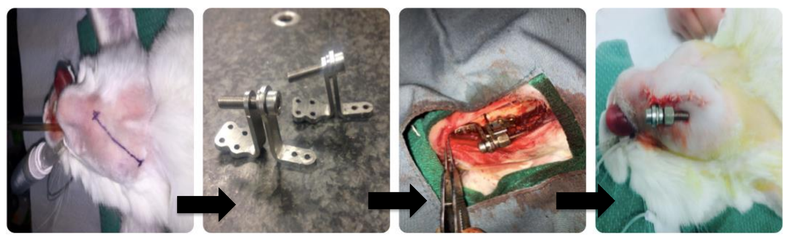
Model
- 20 New Zealand White Rabbits

Surgery
- Each rabbit randomized to control (normal diet) and study (normal diet +Strontium Citrate)
- Surgery preformed

Post Operative Care
- 7 day latency period
- 5 day distraction period (5mm total)
- 4 week consolidation period

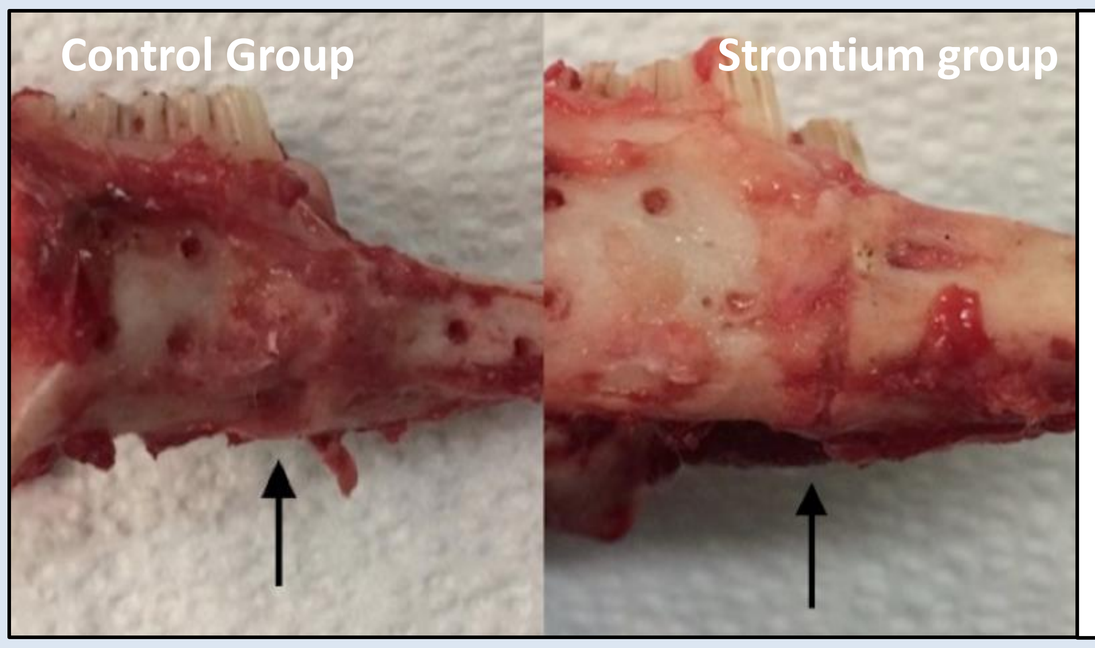
Mandible Analysis
- Macroscopic analysis
- 3D CT/ bone density testing
- Histologic analysis
- Mechanical 3 point bend testing

Procedure



- Performed under general aesthetic
- Mandible exposed, osteotomy created
- External distraction device secure with self tapping screws
- Wound closed in 2 layers around distraction device

Results

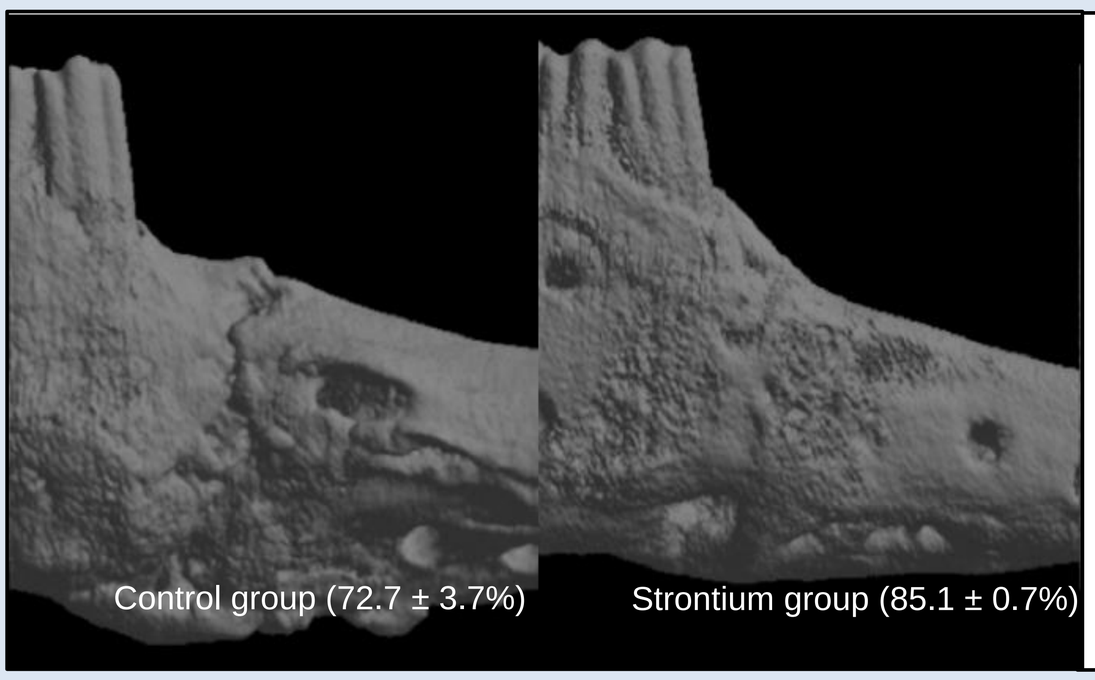


Macroscopic Evaluation

- 18/20 appeared well healed
- Consolidated distraction gap was more similar to native adjacent bone in the study group

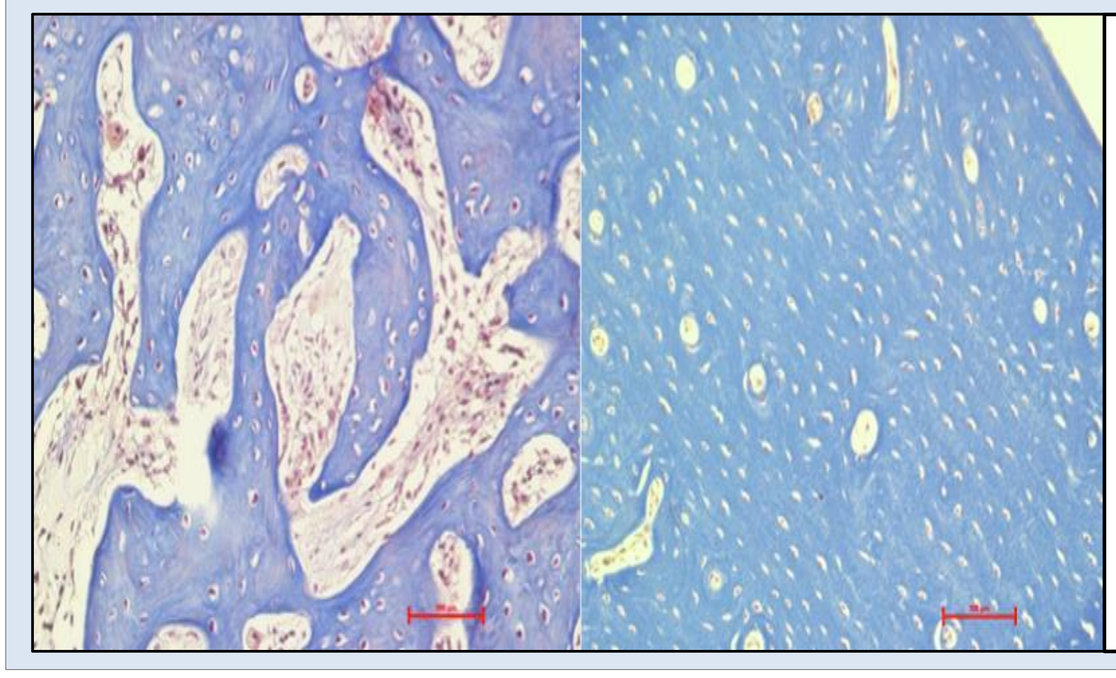
Mechanical 3 point bend test

- Statistically significant increase in maximum load in study group



Radiographic Analysis

- 3D Microcomputed tomography/ bone mineral density
- Statistically significant increase in mean density of bony regenerate in study group (expressed as % similar to normal bone)
- Evidence of more mature bone formation on 3D CT in study group



Histologic Analysis:

- Control: new bone was immature, with sparse trabeculae separated by callous tissue (left panel)
- Study: new bone histologically indistinct from native bone (right panel)
- Similar findings on H&E and masson's trichrome staining

Conclusion

- Strontium citrate effectively accelerated new bone formation in a rabbit model of mandibular distraction osteogenesis
- Oral intake of strontium citrate may be a possible strategy to enhance bone regeneration in distraction osteogenesis
- Prior to human use, further testing using different doses of strontium citrate, with varied distraction and consolidation periods are needed to determine the most favorable regimen for maximal bone regeneration

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