IMPACTION BONE GRAFTING: COMPARISON OF TWO COMPACTION MODES

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Disclosure of conflict of interest

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Introduction

- During Total Hip Arthroplasty (THA) bone loss is recovered by using bone chips
- In order to guarantee sufficient mechanical strength, the porous bone chips have to be compacted

Aim of the study:
- Comparison of two different compaction modes for bone impaction grafting in a in vitro study
Introduction

369 N (SD 95) @ 4,5 Hz  

308 N (SD 115) @ 44 Hz
Materials & Methods

- Cortical and cartilage tissue of human femoral heads were removed with a bone saw.
- From the sponges tissue bone chips were prepared using a bone mill.
- Filled into a plastic cup which simulated the acetabulum.
- Bone mass characteristics were evaluated by 30 measurements taken for each compaction method and for each time step at 0, 3, 6, 9, 12, 15 and 30 [s] of compaction time.
Materials & Methods

Design of the measurement system:

1. Inductive position sensor
2. Punch
3. Plastic cup filled with bone chips
4. Load Cell
5. Signal amplifier

- Bulk density, impaction hardness, contact stiffness and penetration resistance were the parameters of comparison

- The non-parametric U-Test was used for statistical analysis.
Materials & Methods

- **Bulk density**
  \[ \rho = \frac{m}{V_{cp}} \]

- **Penetration Resistance**
  \[ R = \frac{mgH}{\Delta zA} \]

- **Impaction hardness**
  \[ H = \frac{P_{max}}{A} \]

- **Contact stiffness**
  \[ Hs = \frac{P_2}{A} \]
Results

**Impaction hardness**

![Graph showing impaction hardness over compaction time for manual and pneumatic impaction. The graph includes trendlines for each method. The p-value for the difference between manual and pneumatic impaction is p < 0.001.](image)

**Contact stiffness**

![Graph showing contact stiffness over compaction time for manual and pneumatic impaction. The graph includes trendlines for each method. The p-value for the difference between manual and pneumatic impaction is p < 0.01.](image)
Results

Apparent density

Penetration resistance

(p < 0.01)

(p < 0.8)
Conclusion

- Manual impactions show more variable results and depend greatly on the experience of the surgeon.
- Pneumatic impaction of morsellised bone chips achieves higher density values in less time with less force applied. This might reduce the risk of fractures!
- Pneumatic impaction shows more reproducible results than manual impaction.
- Standardisation of the impaction process for acetabular bone defects.
- Density reference value for optimal ingrowth of osteocytes?
Thank you!