IMPACTION BONE GRAFTING: COMPARISON OF TWO COMPACTION MODES

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Introduction

- During Total Hip Arthroplasty (THA) bone loss is recovered by using bone chips

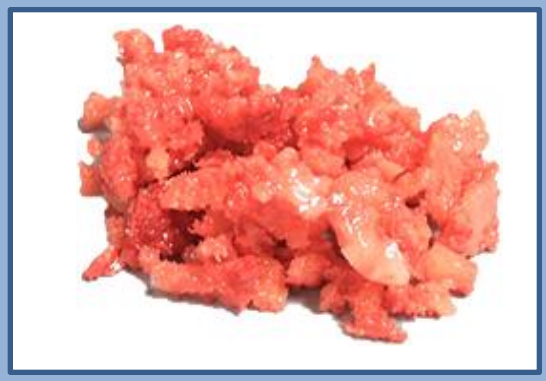
- In order to guarantee sufficient mechanical strength, the porous bone chips have to be compacted

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

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



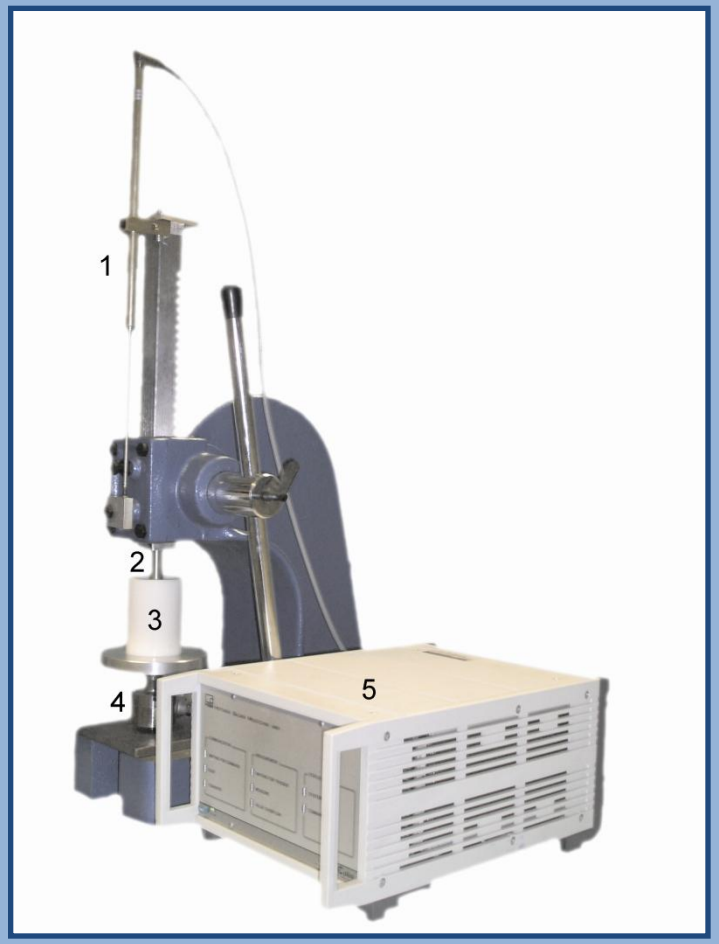
- From the sponges tissue bone chips were prepared using a bone mill
- Filled into a plastic cup which simulated the acetabulum

- 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:

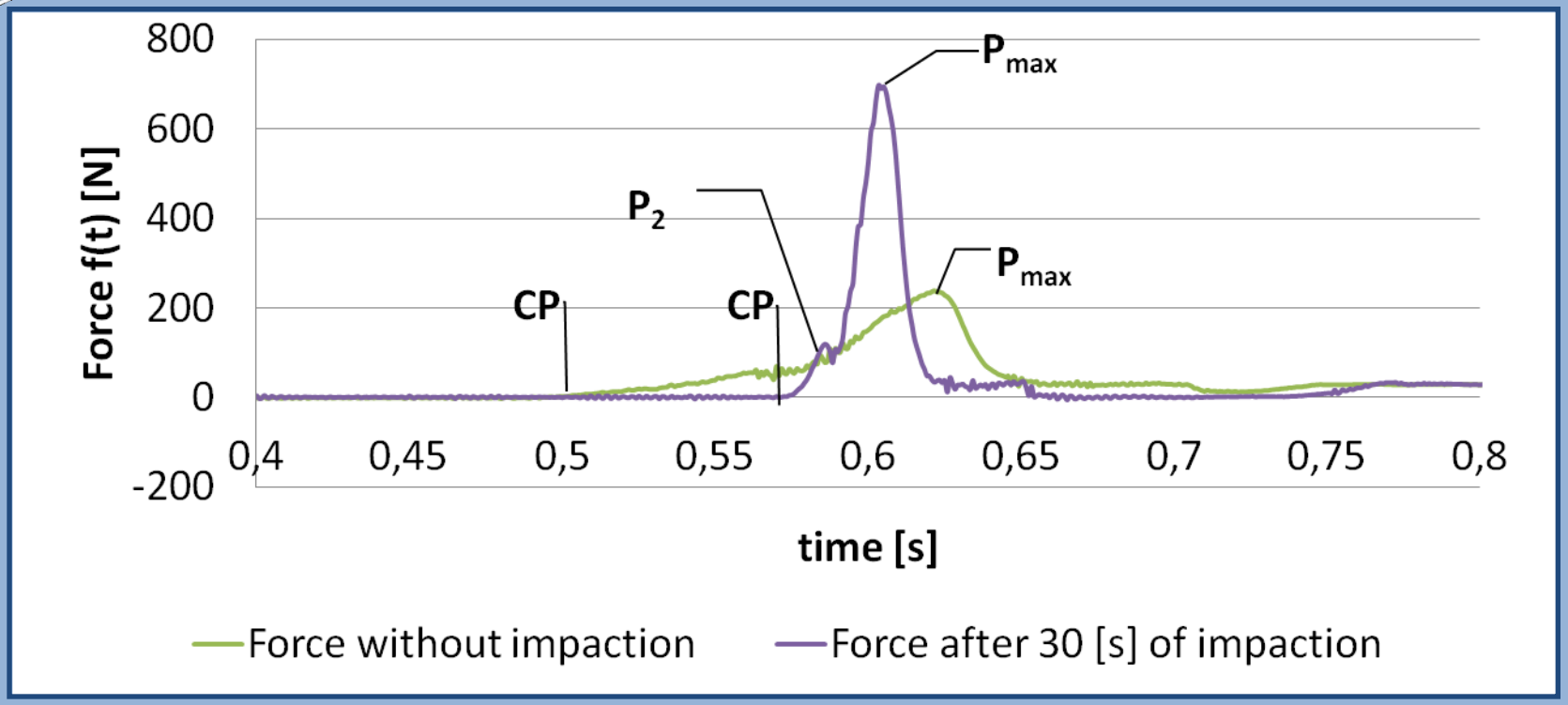
1. Inductive position sensor
2. Punch
3. Plastic cup filled with bone chips
4. Load Cell
5. Signal amplifier



- 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

$$\rho = \frac{m}{V_{CP}}$$

- Impaction hardness

$$H = \frac{P_{max}}{A}$$

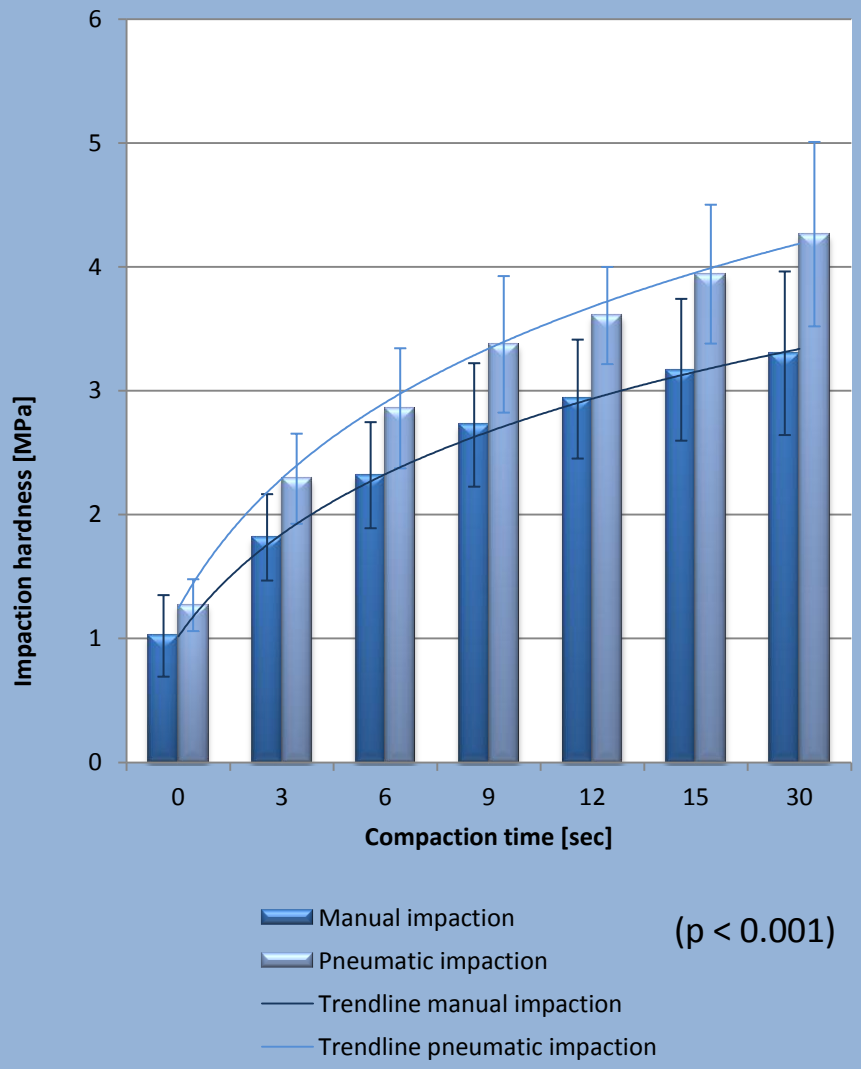
- Penetration Resistance

$$R = \frac{mgH}{\Delta z A}$$

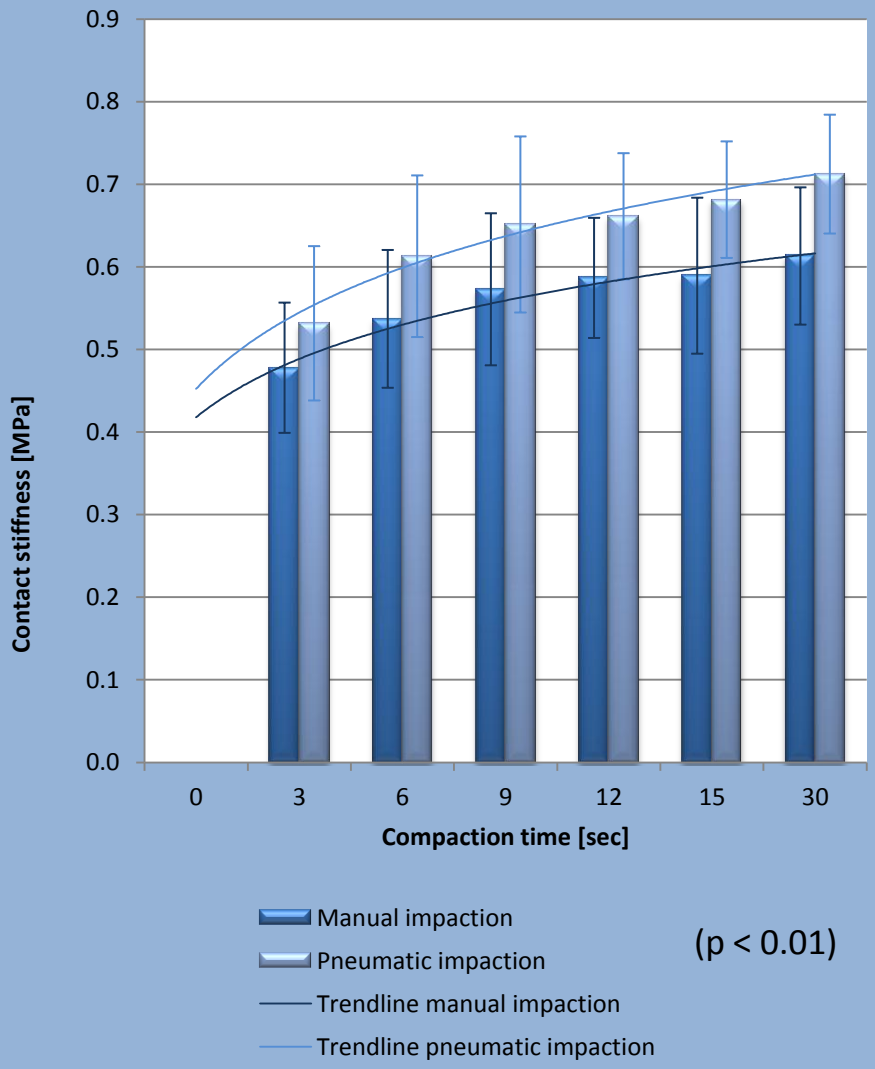
- Contact stiffness

$$Hs = \frac{P_2}{A}$$

Results



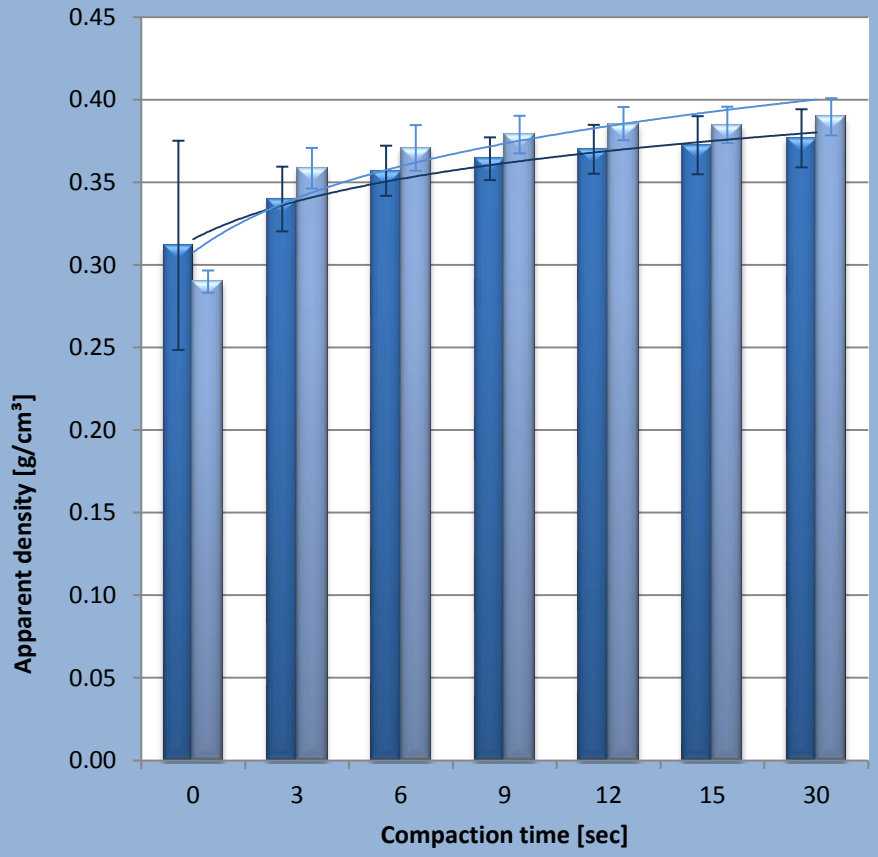
($p < 0.001$)



($p < 0.01$)

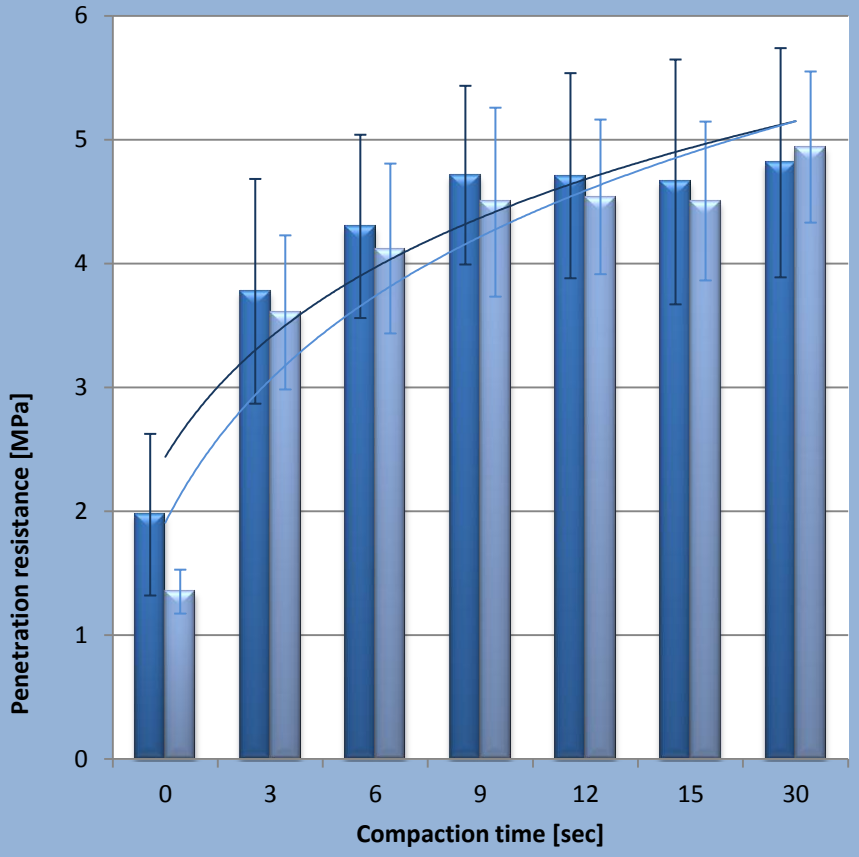
Results

Apparent density



($p < 0.01$)

Penetration resistance



($p < 0.8$)

Conclusion

- Manual impactions shows more variable results and depends 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!