From acellular mineralized cartilage to cellular mature bone
Cox, L.G.E.; van Donkelaar, C.C.; van Rietbergen, B.; Huiskes, H.W.J.; Ito, K.

Published: 01/01/2007

Document Version
Publisher’s PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:
• A submitted manuscript is the author’s version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher’s website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

Citation for published version (APA):
From acellular mineralized cartilage to cellular mature bone

Cox, L.G.E., van Donkelaar, C.C., van Rietbergen, B., Huiskes, R., Ito, K.
Eindhoven University of Technology, Department of Biomedical Engineering

Introduction
Mechanical load influences both endochondral ossification during bone growth, and remodeling of skeletally mature bone. Endochondral bone growth takes place in the growth plates of long bones, consisting of a resting, proliferative and hypertrophic zone (fig. 1). In the hypertrophic zone, extracellular matrix (ECM) is mineralized and mineralized cartilage is finally replaced by bone.

Material and methods
- Proximal tibiae were obtained from 9-month old rats, which had received calceine and alizarine 2 and 1 week before sacrifice to assess the bone growth rate.
- 5µm thick slices were cut with a Leica Jung K microtome.
- Goldner-staining was applied to visualize the microstructure of the growth plate and surrounding bone.

Results
Figure 3 shows that the area where mineralized cartilage remains present is about five times the width of the growth plate, which is a large area. Islands with osteocytes develop on the mineralized cartilage, starting at a small distance from the growth plate.

Future work
- Histology will be used to quantify the morphology of the mineralized cartilage area and surrounding tissue.
- Fluorescent imaging will be used to quantify the distribution of cells within (the vicinity of) the growth plate in relation to the rate of the replacement of cartilage by bone.
- Mathematical modeling will be used to test the hypothesis that the mechanisms used to simulate bone remodeling can also simulate the replacement of cartilage by bone.

References: