

## AAO Foundation Award Final Report

Principal Investigator	Cristina C. Teixeira, DMD, MS, PhD
Co-Investigator	
Secondary Investigators	
Award Type	B. F. Dewel Memorial Biomedical Research Award
Project Title	Engineering Growing Bone
Project Year	2006
Institution	New York University College of Dentistry
Summary/Abstract (approximately 250 words)	<p>Current tissue engineering approaches for bone repair and regeneration explore intramembranous ossification. However, skeletal development can occur by 2 mechanisms: intramembranous and endochondral bone formation. We hypothesize that a mature cartilage scaffold carries all the signals to induce new bone formation. To test our hypothesis we created a cartilage template, <i>in vitro</i>, as the transient model for <i>in vivo</i> endochondral bone formation. <b>Methods:</b> Chick upper sternal chondrocytes were cultured on chitosan sponges, and treated with retinoic acid (RA) to induce maturation. Lower sternal chondrocytes were used as controls. These cells do not undergo maturation in response to RA treatment. Cartilage/chitosan scaffolds were then implanted subcutaneously into nude mice. Tissues were collected every month, for 5 months after implantation. Chondrocyte maturation <i>in vitro</i> and bone formation <i>in vivo</i> were evaluated by microscopic, histological, biochemical, and molecular biology methods, high resolution radiography, and microCT. <b>Results:</b> Chondrocytes attached and proliferated in the chitosan sponges. In response to RA treatment, upper and lower sternal chondrocytes secreted an abundant extracellular matrix, completely obliterating the pores of the sponges, but only upper sternal chondrocytes expressed a mature phenotype. After implantation in mice (non-bone forming region) upper sternal chondrocytes/chitosan scaffolds caused a time dependent increase in mineral content (visible as early as 1 month after implantation) and in bone deposition. Lower chondrocytes/chitosan scaffolds did not induce new bone formation. <b>Conclusions:</b> The mature cartilage/chitosan scaffold is a suitability template for endochondral bone formation. This construct induces vascularization and new bone deposition in and around the template.</p>
Were the original specific aims of the proposal realized?	Yes.
Were the results published?	Two articles are currently in press: 1. S. M. Oliveira, I. F. Amaral, M. A. Barbosa, <u>C. C. Teixeira</u> , Engineering Growing Bone: <i>In Vitro</i> Studies (in press, Tissue Engineering)

	<p>2. S. M. Oliveira, D. Q. Mijares, G. Turner, I. F. Amaral, M. Barbosa, and Cristina <u>C. C. Teixeira</u>, Engineering Growing Bone: <i>In Vivo</i> Studies (in press, Tissue Engineering)</p>
<p>Have the results of this proposal been presented? If so, when and where?</p>	<p>C. C. Teixeira, and S. M. Oliveira, Engineering endochondral bone: in vitro studies. ADR/AADR/CADR 85th General Session, New Orleans, 2007</p> <p>S. M. Oliveira, I. Amaral, M. Barbosa, C. C. Teixeira, Engineering endochondral bone: in vivo studies. ADR/AADR/CADR 85th General Session, New Orleans, 2007</p> <p>S. M. Oliveira, M. Barbosa, C. C. Teixeira, Engineering endochondral bone: in vitro and in vivo studies. 8th World Biomaterials Congress, Netherlands, 2008</p> <p>S.M. Oliveira, M. Alikhani, and C. C. Teixeira, Engineering growing bone, Conferences in Orthodontic Advances is Science and Technology, Pacific Grove, 2008</p>