

## AAO Foundation Award Final Report

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Award Type	Biomedical Research Award
Project Title	Predicting Load-Induced Degradation of the TMJ Disc Through Finite Element Modeling
Project Year	2001
Institution	University of California San Francisco
Summary/Abstract	<p>The long-term aim of our studies is to understand the types and levels of temporomandibular joint (TMJ) loading that predispose to TMJ degeneration and disease. Specifically we are testing whether degradative responses of fibrochondrocytes are spatially and temporally correlated with matrix stresses and strains. To date we have completed two aims of these studies which include: (1) the design, fabrication and calibration of an in vitro loading apparatus that can produce complex regimen of loading in vitro 3 dimensional cellgel constructs. (2) Culture and characterization of chondrogenic cell lines in 3D agarose gels as described below.</p> <p>Significant progress is being made towards generating two-dimensional and three-dimensional tissues using cells of various types. However, there has been limited work in generating viable and functional fibrocartilage. The purpose of our study was to understand the biologic cues required to develop 3D fibrocartilaginous tissue in vitro. We characterized the time-dependent differentiation of clonal chondrogenic fetal rat calvaria cells RCJ 3.1 C5.18, in three-dimensional agarose gels and evaluated the effects of two different media conditions, 10 % fetal bovine serum (FBS) vs. insulin-transferrin-selenium (ITS) with 1 % FBS on the temporal expression of a cartilaginous phenotype. Gel-cell constructs were cultured in either of these two media for 0 days (control), and 1, 2, 3 and 4 weeks following which the specimens were collected and analyzed for total collagen and proteoglycan. We also analyzed h% chondrocytic genes aggrecan and collagen type II a1 using quantitative RT-PCR.</p> <p>The concentration of proteoglycan in the constructs increased significantly over time by more than 10 fold in FBS and by more than 5 folds in ITS media. With FBS media treatment, aggrecan mRNA levels rose sharply peaking at 94-fold increase in the third week. With ITS media, aggrecan mRNA levels were not significantly increased relative to day 0. The concentration of collagen also increased with FBS media peaking at 1.8 fold greater levels than at day 0. In contrast, there was a</p>

	<p>decrease in collagen with ITS media. With FBS media, collagen type II mRNA levels rose sharply, peaking at a 64-fold increase in the third week. With ITS media, collagen type II mRNA levels were not significantly increased through the culture period, Our findings suggest that that RCJ5.18 cells undergo a medium-dependent and time-dependent chondrocytic differentiation when grown in agarose gel scaffolds with FBS media but not with ITS media.</p>
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