11-9-2018

Effects of Hypothyroidism on Articular Cartilage in Juvenile Swine

Joshua Bundy  
*Marian University - Indianapolis*

Dennis Weiner MD

Julianne Yang MD

Robin Childs MS

Melanie Morscher PT

*See next page for additional authors*

Follow this and additional works at: https://mushare.marian.edu/mucom_rd

Part of the *Medicine and Health Sciences Commons*

**Recommended Citation**

Bundy, Joshua; Weiner, Dennis MD; Yang, Julianne MD; Childs, Robin MS; Morscher, Melanie PT; Steiner, Richard Ph.D; Adamczyk, Mark MD; and Landis, William Ph.D, “Effects of Hypothyroidism on Articular Cartilage in Juvenile Swine” (2018). MU-COM Research Day. 96.  
https://mushare.marian.edu/mucom_rd/96

This Poster is brought to you for free and open access by the College of Osteopathic Medicine at MUSHare. It has been accepted for inclusion in MU-COM Research Day by an authorized administrator of MUSHare. For more information, please contact emandity@marian.edu.
Authors
Joshua Bundy, Dennis Weiner MD, Julianne Yang MD, Robin Childs MS, Melanie Morscher PT, Richard Steiner Ph.D, Mark Adamczyk MD, and William Landis Ph.D

This poster is available at MUShare: https://mushare.marian.edu/mucom_rd/96
INTRODUCTION

Articular Cartilage
• Highly specialized connective tissue
• Functions as smooth, wear resistant joint surface
• Composition includes:
  o Chondrocytes
  o Extracellular matrix (ECM)
    ▪ Collagen fibrils
    ▪ Proteoglycans
• Relatively avascular and poor ability to repair

Thyroid Hormone
• Influence articular cartilage growth
• Triiodothyronine (T3) increases in vitro collagen production
• Unknown effects on developing articular cartilage

Theory
• Understanding articular cartilage development may be the link to understanding repair
• Because pediatric donor tissue is difficult to obtain, and miniature swine proximal femoral anatomy resembles human anatomy, an animal model is appropriate

Purpose
• To compare the effects on articular cartilage in hypothyroid animals to control animals

METHODS
• Established hypothyroidism in two (2) juvenile miniature swine by administering 6-Propyl-2-thiouracil (PTU) in drinking water with two (2) additional animals serving as controls
• Serum TSH, T3, and T4 levels monitored weekly
• Sacrificed at 25 weeks of age
• Proximal femurs harvested, fixed, demineralized, and processed for histology and immunohistochemistry (IHC)

Measures & Analysis
• Histomorphometry
  o Mean articular cartilage thickness
  o Mean articular cartilage cell density
• Nested mixed effects ANOVA with α = 0.05

RESULTS
• Hypothyroid articular cartilage demonstrates changes in gross tissue morphology and histology staining, compared to controls (See Figures 1 and 2)
  o Increased proteoglycan
  o Decreased type II collagen
• Hypothyroid articular cartilage demonstrates differences in histomorphometry, compared to controls (See Table 1)
  o Increased mean articular cartilage thickness
  o Decreased mean articular cartilage cell density

DISCUSSION
• First study to investigate the effects of hypothyroidism on articular cartilage
• Hypothyroid articular cartilage may be biomechanically weaker
  o Increased proteoglycan
  o Decreased type II collagen
• Findings may help understand articular cartilage development and repair mechanisms
• Findings may help explain genesis of femoral head deformity in pediatric hypothyroidism and Legg–Calvé–Perthes disease (LCPD)

Limitations
• Primarily a qualitative study with a small sample size

Conclusion
• Hypothyroid articular cartilage demonstrated:
  o Increased thickness
  o Decreased cell density
  o Increased proteoglycan staining
  o Decreased type II collagen staining
• These data support the idea that thyroid hormones are fundamental to articular cartilage development

Table 1: Histomorphometry of articular cartilage

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>x̅</th>
<th>SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (μm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>2</td>
<td>1076</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothyroid</td>
<td>2</td>
<td>2335</td>
<td>±133</td>
<td>0.021 *</td>
</tr>
<tr>
<td>Cell Density (cells/cm²)</td>
<td></td>
<td>27.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>2</td>
<td>31.0</td>
<td>±1.0</td>
<td>0.016 *</td>
</tr>
<tr>
<td>Hypothyroid</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>