

 MUSCULOSKELETAL BIOLOGY AND BIOENGINEERING

Growth plate or articular: whatever your cartilage type, thyroid hormones are in control!

Although the thyroid hormones triiodothyronine (T3) and parathyroid hormone (PTH) are known to have a role in regulating growth-plate cartilage development, whether articular chondrocytes can respond to these hormones was unknown until now. Research published in *Arthritis Research & Therapy* shows that, in a scaffold-free cartilage tissue engineering model, sequential exposure of chondrocytes to these hormones contributes to cartilage regeneration and function.

As the lead authors on this paper Jennifer Lee and Kyriacos Athanasiou say, “Motivated by the importance of the thyroid hormones in growth-plate development, we sought to investigate whether they could be applied to the development of our self-assembling neocartilage, toward engineering an articular cartilage tissue replacement.” The self-assembling neocartilage process used is a scaffold-free tissue

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engineering method that recapitulates cartilage development. “A high-density cell suspension is seeded into a nonadherent well and, within a few hours, the cells undergo cell–cell recognition and begin secreting a collagen-rich and glycosaminoglycan-rich extracellular matrix,” explain Lee and Athanasiou. This model allows the effects of various stimuli on cartilage matrix synthesis and maturation to be studied.

The experiments comprised two phases each involving 4 weeks of neocartilage culture. Addition of T3 during week 1 resulted in cartilage constructs with increased compressive and tensile properties and increased collagen production compared with untreated or

PTH-treated neocartilage constructs. By week 4, T3 treatment resulted in deposition of collagen type X, a marker of hypertrophy; sequential treatment with T3 for week 1 and PTH for weeks 2–4 led to reduced deposition of collagen type X.

“We decided to adopt a sequential hormone treatment approach to first enhance our neocartilage properties using T3, followed by treatment with PTH to reduce the hypertrophic marker expression. Sequential application of these hormones significantly improved the mechanical properties of articular chondrocyte-based neocartilage, while simultaneously reducing the hypertrophic effects,” conclude Lee and Athanasiou.

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Original article Lee, J. K. *et al.* Thyroid hormones enhance the biomechanical functionality of scaffold-free neocartilage. *Arthritis Res. Ther.* doi:10.1186/s13075-015-0541-5