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Meniscus matrix morphological composition: age-dependent evaluation in a swine model

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Abstract

Menisci are fibro-cartilaginous structures interposed between femoral condyle and tibial plateau, which have multiple functions in the stifle joint: act as shock absorbers, bear loaders and allow joint stability, congruity and lubrication (Sweigart *et al.*, 2004; Proffen *et al.*, 2012). It is well known that meniscal injuries lead to osteoarthritis and for these reasons, menisci are considered important target of investigation. Their important role in the knee wellness is only equalled by their deficiency in proper self-repairing.

Nowadays, the gold standard technique is not just to remove the damaged meniscus, but to rebuild it or to replace it. For these reasons, studies are necessary to increase the knowledge about these small but essential structures (Streuli, 1999; Deponti *et al.*, 2013). Composition and morphology are basic fundamental information for the development of engineered meniscal substitutes (Di Giancamillo *et al.*, 2014). The analysis of the morphological, structural and biochemical changes, which occur during growth of the normal menisci, represent the goal of the present study. For this purpose, menisci from adult (7-month old), young (1-month old), and neonates (stillbirths) pigs were collected. Cellularity and glycosamiglycans (GAGs) deposition were evaluated by ELISA, while Collagen-1 and Collagen-2 were investigated by immunohistochemistry and Western blot analyses. Cellularity ($P<0.01$, all comparisons) and Collagen-1 ($P<0.05$, neonatal-young vs adult) decreased from neonatal to adult stage while GAGs ($P<0.01$ neonatal vs young-adult) and Collagen-2 ($P<0.01$ neonatal-young vs adult) showed the opposite trend. Immunohistochemistry revealed similar changes occurring during animal growth thus revealing that cellular phenotype, cellularity and protein expression, as well as fibers aggregation in the matrix, are dissimilar in the three ages analysed categories. These changes reflect the progressive menisci maturation and hyper-specialisation. We observed the correlation between biochemical and phenotype properties of swine menisci follow age-dependent changes during growth: starting with an immature cellular and fiber pattern to the mature organised and differentiated adult menisci.

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References

Deponti, D., Di Giancamillo, A., Scotti, C., Peretti, G.M., Martin, I., 2013. Animal models for meniscus repair and regeneration. J Tissue Eng Regen Med. 9 (5), 512-527

Di Giancamillo, A., Deponti, D., Addis, A., Domeneghini, C., Peretti, G.M., 2014. Meniscus maturation in the swine model: changes occurring along with anterior to posterior and medial to lateral aspect during growth. J. Cell. Mol. Med. 18 (10), 1964-1974.

Proffen, B.L., McElfresh, M., Fleming, B.C., Murray, M., 2012. A comparative anatomical study of the human knee and six animal species. The Knee. 19 (4), 493–499.

Streuli, C., 1999. Extracellular matrix remodelling and cellular differentiation. Current Opinion in Cell Biology. 11 (5), 634–640.

Sweigart, M.A., Zhu, C.F., Burt, D.M., Deholl, P.D., Agrawal, C.M., Clanton, T.O., Athanasiou, K.A., 2004. Intraspecies and Interspecies Comparison of the Compressive Properties of the Medial Meniscus. Annals of Biomedical Engineering. 32 (11), 1569–1579.

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