

審査の結果の要旨

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The research conducted in this Ph.D. dissertation covered four studies as follows. The first study looked at the effect of dynamic hydrostatic pressure on *ex vivo* development of immature knee joints with a focus on endochondral ossification. The second study utilized a photo-crosslinkable hydrogel (MeHA) model for cartilage tissue engineering. The third study explored the potential of using an inorganic polyphosphate-conjugated HA hydrogel (HAX-PolyP) model for bone tissue engineering. The last study combined MeHA and HAX-PolyP from the previous studies to form a novel bilayer model for osteochondral tissue engineering. Furthermore, mechanical stimulation including dynamic compression and hydrostatic pressure were applied in Studies 2, 3 and 4 to examine their effect on enhancing *in vitro* maturation of tissue-engineered constructs.

There is plenty novelty in these studies, where Study 1 gave insight and helped to elucidate the role of hydrostatic pressure in post-natal joint maturation, which has not been done before. The latter studies focused on tissue engineering where novel biomaterials, i.e. functionalized HA hydrogels, were synthesized. Especially in Study 3, the concept of immobilizing inductive factors is still a relatively new field, yet the findings demonstrated the potential and ease of utilization of this technique. The osteochondral tissue engineering model developed in Study 4 is also original, featuring controlled differentiation of a single stem cell source into two distinct tissue types simultaneously under a common culturing environment. This has been one of the biggest hurdles in tissue-engineering complex multiphasic tissue targets, where robust methods do not exist currently.

The amount of research and experimentation conducted in this dissertation was viewed to be plentiful for graduation. The candidate has also addressed the comments raised by the committee members during the pre-defense and revised his final dissertation and defense accordingly without fail. As such, all committee members were satisfied with the revision and requested no further improvements. In regards to achievements, the candidate has presented his work in both domestic and international conferences. In addition, the findings from Study 3 have already been summarized and published as an original article in a peer-review journal. Two more publications can be expected from the findings in the other studies as well. Therefore in conclusion, all committee members are in agreement in granting the candidate his Ph.D. degree.

よって本論文は博士（工学）の学位請求論文として合格と認められる。