

# Fabrication of Cartilage/Natural Rubber Latex Biocomposites Derived From Human Mesenchymal Stem Cells

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## Extended Abstract

To broaden the knowledge regarding regenerative medicine in natural rubber latex (NRL) nanoparticles, we have examined the chondrogenesis ability of NRL nanoparticles *in vitro* against human mesenchymal stem cells (hMSCs) in hypoxia. NRL nanoparticles had enhanced the cell proliferation of hMSCs. The results demonstrate higher biocompatibility of the NRL nanoparticles without a significant vitality reduction for hMSCs [1].

We have successfully fabricated the cartilage/NRL biocomposites via hMSC spheroid under hypoxic condition, where the administration of NRL nanoparticles exhibits the suppression of the spheroid contraction due to the cellular proliferation of hMSCs. It has been emerged that the NRL nanoparticles acted as a main component, which provides surface heterogeneity of the spheroid, leading to a mechanically stable structure with 8-fold higher modulus in comparison with the control as revealed by atomic force microscopy microindentation.

We have demonstrated that the formation of the cartilage/NRL nanoparticles biocomposite results in having a stiff surface. The gene expression level of SRY-box 9 (SOX9), aggrecan and collagen type-II (Col-II), and glycosaminoglycans formation were high in the spheroid under hypoxic condition, indicating that chondrogenic differentiation was successfully induced by the administration of NRL nanoparticles.

The results showed promise of the NRL nanoparticles for well-controlled chondrogenic differentiation and mechanically stable cartilage tissue. Further efforts are needed to explore the viscoelastic and long-term properties of the biocomposites for cartilage tissue [2].

## Funding

This work was supported by the KAKENHI of the Ministry of Education, Sports, Science and Technology, Japan.

## References

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- [2] Y. Okamoto, K. Kinoshita, M. Okamoto, *Nanocomposites*, 6, 137 – 148, 2020.