Liquid marbles: a cost-effective platform to generate cardiospheres from co-cultured cardiomyocytes and cardiac fibroblast for disease modelling

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Contact person

Jolanda van Hengel

Organisation

Name of the organisation Ghent University (UGent)

Department Faculty of Medicine and Health Sciences

Country Belgium

Geographical Area Flemish Region

SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Basic Research
Type of method	In vitro - Ex vivo
Specify the type of cells/tissues/organs	Human pluripotent stem cell derived cardiomyocytes and human pluripotent stem cell derived cardiac fibroblast

DESCRIPTION

Method keywords

Liquid marble

Cardiomyocyte

cardiac fibroblast
3D cardiospheres
induced pluripotent stem cells
cardio

Scientific area keywords

cardiac disease modelling
cardiovascular disorders
in vitro 3D modelling
Coculture model

Method description

Advances in three-dimensional (3D) culture techniques have shown several advantages over 2D cultures, especially by more accurately mimicking the *in vivo* environment. This has led to improved reproducibility and reliability of experimental results, which are important criteria in disease modelling and toxicity testing. Induced pluripotent stem cells (iPSC) provide an unlimited source for the derivation of all cell types of the adult body, including cardiomyocytes. To improve the current culture methods for multicellular cardiac spheroids, such as the hanging drop method, we explored the use of hydrophobic powders. Fumed silica nanoparticles can be used to encapsulate liquid drops, which could serve as a microenvironment for cell cultures. This microbioreactor stimulates cell coalescence and 3D aggregation while providing optimal gas exchange between the interior and the surrounding environment. Moreover, the properties of liquid marble microbioreactors render them ideal for co-culture experiments. This liquid marble technique has been previously explored and optimized for other cell types. Here we describe a protocol that allows for the derivation of functional cardiac mini organoids, consisting of co-cultured cardiomyocytes and cardiac fibroblasts. These cardiospheres can be valuable for modelling cardiac diseases *in vitro* and assessing cell interactions to decipher disease mechanisms.

Lab equipment

- Biosafety cabinet;
- Incubator.

Method status

Still in development

Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

- Inexpensive;
- Easy to learn;
- No specialized equipment required;
- Versatile applications;
- Formation of 3D structures in relatively short time (24h);
- Small volumes and cell numbers required.

Challenges

Susceptible to environment changes such as temperature and humidity.

Future & Other applications

Liquid marble technology in principle can be applied with other cell types to generate 3D structures.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

J. Aalders, L. Léger, T. Tuerlings, S. Ledda, and J. van Hengel, “Liquid marble technology to create cost-effective 3D cardiospheres as a platform for in vitro drug testing and disease modelling,” METHODSX, vol. 7, 2020. doi:10.1016/j.mex.2020.101065

J. Aalders, L. Léger, D. Piras, J. van Hengel, and S. Ledda, “Use of transparent liquid marble : microbioreactor to culture cardiospheres,” in Next generation culture platforms for reliable in vitro models, vol. 2273, T. Brevini, A. Fazeli, and K. Turksen, Eds. Humana, 2021, pp. 85–102. doi:10.1007/978-1-0716-1246-0_5

Links

Liquid marbles for disease modelling (poster presentation)

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