Human Dental Pulp Stem Cells as a Patient-in-a-Dish Model for Charcot-Marie-Tooth Disease Type 1A

Commonly used acronym: *DPSC-SC CMT1A*

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Organisation

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Department BIOMED
Specific Research Group or Service Team FIERCE
Country Belgium
Geographical Area Flemish Region

Partners and collaborations

University of Hasselt (UHasselt)

SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Basic Research, Translational - Applied Research
Type of method	In vitro - Ex vivo
Specify the type of cells/tissues/organs	Dental pulp stem cells

DESCRIPTION

Method keywords

Disease modeling
mesenchymal stem cell
Peripheral neuropathy
Lentiviral transduction
CRISPR-Cas9
cellular differentiation
Patient-derived

Scientific area keywords

Charcot-Marie-Tooth disease type 1A
demyelination
basic research
Schwann cells

adult stem cells
Human Stem cells

Method description

Dental pulp stem cells (DPSC) are mesenchymal stem cells residing within the inner mucoid core (dental pulp) of teeth, responsible for tissue turnover and regeneration. Since third molars, or wisdom teeth, are frequently extracted for orthodontic reasons, DPSC are a highly accessible stem cell source. DPSC exhibit high proliferation rates and can be cryopreserved for long periods, rendering them suitable for biobanking. In addition, DPSC are embryonically derived from the neural crest lineage, sharing their origin with myelinating Schwann cells. Hence, we have developed a protocol to differentiate human DPSC towards functional Schwann cells called DPSC-SC. Furthermore, we have implemented these DPSC-SC as a novel research model for Charcot-Marie-Tooth disease type 1A (CMT1A). CMT1A is the most common demyelinating peripheral neuropathy. Previous research has evidenced that CMT1A animal models lack translatability and that human models are necessary to bridge the gap between preclinical and clinical research. We are using human DPSC-SC for CMT1A modeling by mimicking the disease using lentiviral transduction and CRISPR-Cas9 while also building a biobank of patient-derived DPSC-SC.

Lab equipment

Laminar Flow Cabinet, Incubator, Centrifuge

Method status

Still in development
History of use
Internally validated
Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

- Human disease model,
- Highly accessible,
- Cost-effective,
- Unique DPSC differentiation potential allows for derivation of more mature Schwann cells,
- Possibility of genetically engineering cells,
- Novel patient-derived biobank representing the hetereogeneity of the diesase,
- Drug screening.

Future & Other applications

DPSC are currently being used for multiple regenerative applications in many fields of science including dentistry, oncology, and cardiology. DPSC-SC have potential in all research fields related to peripheral neuropathies. Our CMT1A model will undergo further optimization and will be used for generating 3D co-cultures with neuronal cells to investigate myelination defects.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Martens W, Sanen K, Georgiou M, et al. Human dental pulp stem cells can differentiate into Schwann cells and promote and guide neurite outgrowth in an aligned tissue-engineered collagen construct in vitro. FASEB J. 2014;28(4):1634-1643. doi:10.1096/fj.13-243980

Associated documents

The FASEB Journal - 2013 - Martens - Human dental pulp stem cells can differentiate into Schwann cells and promote and (2).pdf