Artificial ovary prototype mimicking human ovarian tissue architecture

Commonly used acronym: *TAO*

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Organisation

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SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Basic Research, Education and training, Translational - Applied Research
Type of method	In vitro - Ex vivo
Specify the type of cells/tissues/organs	Ovarian preantral follicles

DESCRIPTION

Method keywords

Fibrin matrix

Isolated follicles

Artificial ovary

Ovarian cells

Scientific area keywords

Human ovarian tissue

fertility preservation

Cryopreservation

Transplantation

Method description

We aimed to optimize fibrin matrix composition in order to mimic human ovarian tissue architecture for human ovarian follicle encapsulation and grafting. Ultrastructure of fresh human ovarian cortex in age-related women (n = 3) and different fibrin formulations (F12.5/T1, F30/T50, F50/T50, F75/T75), rheology of fibrin matrices and histology of isolated and encapsulated human ovarian follicles in these matrices. Fresh human ovarian cortex showed a highly fibrous and structurally inhomogeneous architecture in three age-related patients, but the mean ± SD of fiber thickness (61.3 to 72.4 nm) was comparable between patients. When the fiber thickness of four different fibrin formulations was compared with human ovarian cortex, F50/T50 and F75/T75 showed similar fiber diameters to native tissue, while F12.5/T1 was significantly different (p value < 0.01). In addition, increased concentrations of fibrin exhibited enhanced storage modulus with F50/T50, resembling physiological ovarian rigidity. Excluding F12.5/T1 from further analysis, only three remaining fibrin matrices (F30/T50, F50/T50, F75/T75) were histologically investigated. For this, frozen-thawed fragments of human ovarian tissue collected from 22 patients were used to isolate ovarian follicles and encapsulate them in the three fibrin formulations. All three yielded similar follicle recovery and loss rates soon after encapsulation. Therefore, based on fiber thickness, porosity, and rigidity, we selected F50/T50 as the fibrin formulation that best mimics native tissue.Of all the different fibrin matrix concentrations tested, F50/T50 emerged as the combination of choice in terms of ultrastructure and rigidity, most closely

resembling human ovarian cortex.

Lab equipment

- Tissue chopper;
- Stereomicroscope;
- Biosafety cabinet;
- Incubator;
- Inverted microscope.

Method status

Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

In vitro culture of human follicles

Challenges

- Fibrin matrix degradation;
- Poor visibility of the follicles inside the gel.

Modifications

Yes, fibrin composition (slower degradation rate, higher transparency)

Future & Other applications

In vitro culture of ovarian cells

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Chiti, M.C., Dolmans, MM., Mortiaux, L. et al. A novel fibrin-based artificial ovary prototype resembling human ovarian tissue in terms of architecture and rigidity. J Assist Reprod Genet 35, 41–48 (2018). https://doi.org/10.1007/s10815-017-1091-3

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