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P-295 Application of a Time-Lapse Optical Coherence Tomography (OCT) approach in a pilot study to visualise oocytes and embryos in depth

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Study question: Can we visualise model oocytes and embryos during embryo development using OCT non-invasively?

Summary answer: This approach, new to embryology, OCT, allows visualising cells in a 3D perspective, providing more detailed information than standard microscopy from the oocyte or embryo.

What is known already: Time-lapse is a well-established technique in human IVF, but it is limited in its depth of view due to the limitations of classical microscopy. To overcome this limitation, the approach of Optical Coherence Tomography (OCT), allows non-invasive visualisation through optical cross-sections of the embryo or oocyte to produce 3D images. The obtained information can be extended to 4 or 5 dimensions to track movement and elasticity, using a low-power light source and no staining to ensure the minimum effect on the cell. Here, a pilot study was performed in model (porcine) samples using a newly developed "in incubator" system.

Study design, size, duration: A pilot basic study was performed where 16 oocytes and 16 cleavage embryos were obtained and prepared to be visualised using OCT.

Participants/materials, setting, methods: Pig ovaries were obtained from a slaughterhouse, from which follicles were aspirated in order to retrieve oocytes. The best-quality oocytes were cultured for maturation for 44 hours and 16 oocytes were selected for OCT imaging. before fertilisation for 2 hours. Sperm was previously prepared by Percoll gradient. Zygotes were cultured for 6 days until visualisation through OCT. For imaging, samples were prepared in a 16-well Primo Vision dish.

Main results and the role of chance: Oocytes and embryos were successfully imaged, allowing the identification of distinct cellular features. In oocytes, it was possible to identify the germinal vesicle (nucleus) and polar bodies, individual blastomeres in cleavage stage embryos and trophectoderm, ICM and blastocoel in blastocysts. As images were taken throughout different optical sections, it was possible to correlate the position of the areas within the oocytes/embryos and create a 3D image from a blastocyst, understanding the size of the inner cell mass compared with the embryo's overall size. Interestingly, images were obtained non-invasively and under optimal conditions (in an incubator), demonstrating the future utility of OCT for embryo imaging.

Limitations, reasons for caution: An experimental OCT system was developed and placed in the incubator, and all images obtained were in a format of a pilot study. Future imaging sessions are planned to obtain more data points and assess the viability of the embryo.

Wider implications of the findings: Although in the present study, OCT was applied in pig oocytes and embryos, this new approach can be employed in future for human IVF to overcome the current imaging limitations, proving more information on the oocytes and embryos' quality and assisting Artificial Intelligence analysis.

Trial registration number: not applicable