World's First Device for Predicting Oocyte Quality

Highlights

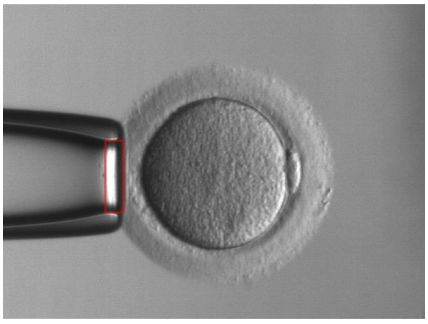
- Classifies oocytes into grades A, B, or C
- Oocytes of higher grades have shown increased rates of blastocyst formation and embryo implantation
- Selection of higher quality oocytes for the social freezing or egg donation process

The Importance of Egg Quality

Assisted Reproductive Technology (ART) is a key solution for clinical infertility. However, despite the general clinical pregnancy rate per treatment cycle exceeding 40%, the egg utilization rate is below 10%. This shows that 90% of the eggs do not develop into live births, leading to a large number of eggs or embryos being frozen or discarded.

In ART treatments, egg quality significantly impacts early fertilization, embryo development, and eventually determines the clinical pregnancy and live birth rates. Despite the crucial role of egg quality, effective and reliable methods for evaluating it are limited in clinical practice. Currently, there are no standardized guidelines for selecting oocytes likely to develop into viable blastocysts for transfer or vitrification.

Development of Opal



Opal was developed from prior research [(1)] at Stanford University. This research demonstrated that viscoelastic properties can predict human blastocyst formation with over 90% precision, 95% specificity, and 75% sensitivity within hours of fertilization. This technological innovation measures zona pellucida elasticity, enabling quick and safe assessment of egg quality in both fresh and frozen cycles.

Growing evidence suggests that the viscoelastic properties of oocytes closely reflect their quality. For example, extra-soft mouse oocytes often exhibit impaired chromosome alignment (citation). The zona pellucida hardens after fertilization, and dysmorphic oocytes tend to be softer than healthy oocytes for cryopreservation. These findings highlight the importance of assessing oocyte viscoelastic properties to gauge their health and quality.

OPAL provides a comprehensive workflow to extract viscoelastic attributes and build predictive models based on these metrics. This predicts the developmental potential of mature oocytes. The classifier outperforms predictions based on morphology or maternal factors in predicting usable blastocyst formation. This underscores OPAL's potential to enhance predictive accuracy across assisted reproductive technology processes.

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Usage of Opal

1. Egg Freezing

OPAL can be used to determine the quality of oocytes before cryopreservation since there are no standardized guidelines for assessing their quality. For women undergoing social freezing and patients opting for oocyte cryopreservation, oocyte grading can provide better information for reproductive planning and guide decisions on additional banking. In the oocyte donation process, higher-graded oocytes can be grouped for better results, leading to more viable embryos for transfer.

2. IVF/ICSI

OPAL can assist in several aspects of IVF procedures:

- **Selection of eggs for insemination**

  In countries where the number of fertilizations is regulated by the government, choosing better quality eggs is crucial to ensure higher fertilization and blastocyst formation. For patients, such as those with PCOS who have high egg yields but low pregnancy rates, selecting better quality eggs is essential for effective treatment.

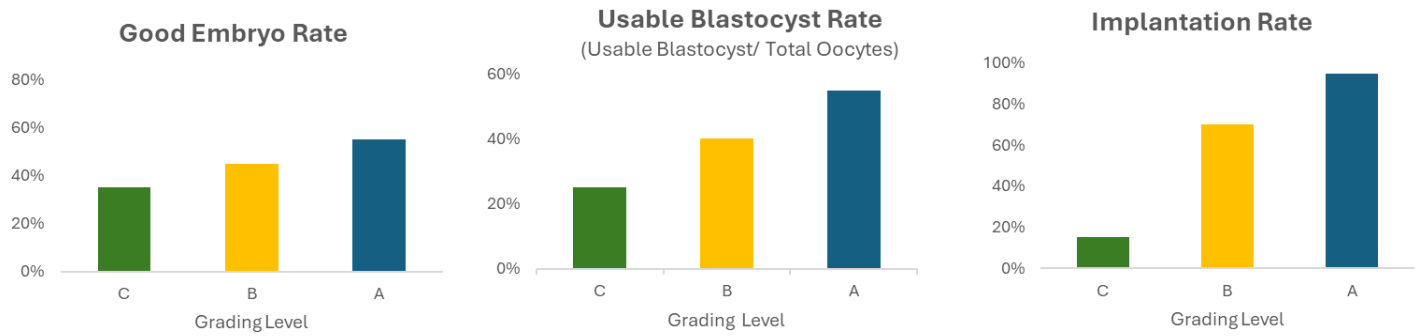
- **Prediction of usable blastocyst formation**

  For patients whose fertilized eggs can only reach a certain embryo stage or for laboratories that only culture embryos up to Day 3, using egg quality to predict blastocyst stage embryo formation is valuable. OPAL has shown that egg quality correlates with usable blastocyst formation rates, providing guidance on which early-stage embryos to transfer.

- **Prediction of clinical pregnancy rate**

  OPAL has demonstrated that better quality eggs can result in higher implantation rates. Egg quality can be used as one of the factors for choosing embryos.

Data

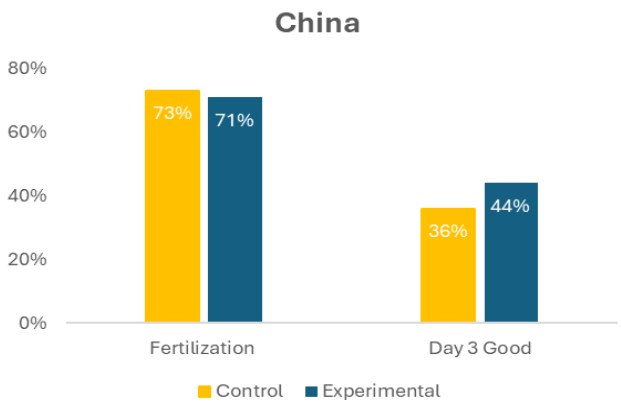


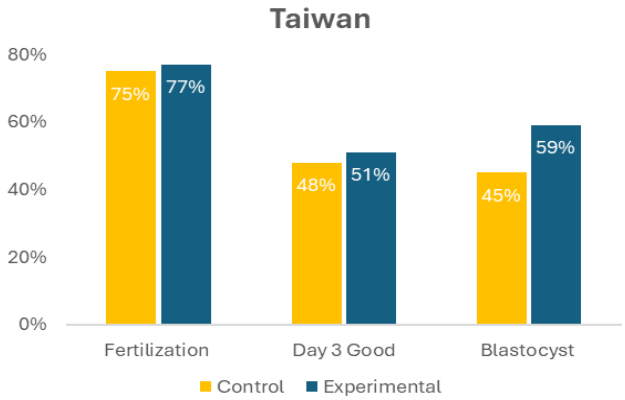
OPAL assesses the viscoelastic properties of oocytes and classifies them into three grades (A, B, C). Grade A oocytes demonstrate superior quality and higher implantation rates, as evidenced by our analysis of 488 oocytes. The data shows that Grade A oocytes achieved a 55% rate of becoming usable

blastocysts, resulting in a 95% implantation rate. In contrast, Grade C oocytes exhibited lower rates, with only 25% of fertilized oocytes becoming usable blastocysts, leading to only a 15% implantation rate. These findings underscore OPAL's effectiveness in helping clinicians select higher quality oocytes, thereby enhancing reproductive outcomes in ART procedures.

Safety

The measurement of the viscoelasticity of the oocytes by OPAL has been proven to be safe and effective[2]. In the study comparing the fertilization rate, embryo rate, and blastocyst rate between the OPAL-measured group and the control group, no negative impact was found when using OPAL. There was no significant difference in fertilization rates between the groups. Embryo development on days 3 and 5 was not negatively affected, validating the safety of OPAL's procedure.





OPAL's Utilization and Analysis Process

OPAL works in conjunction with ICSI and can be easily integrated. Immediately after egg retrieval and before sperm injection, OPAL holds and measures denuded mature eggs using a method that applies a fixed micro-suction force through a micropipette. This process calculates the egg's viscoelasticity within 5-7 seconds, immediately providing an egg grading.

OPAL's analysis model for oocyte grading includes a feature processing engine and a predictive model. The engine first receives recorded videos of the aspiration process and the corresponding pressure value as inputs. It processes these inputs to generate features that cover both mechanical and morphological characteristics of the oocytes. OPAL's predictive model uses these extracted features to determine and assign the oocyte grading.

References

1. Yanez LZ, Han J, Behr BB, Pera RAR, Camarillo DB. Human oocyte developmental potential is predicted by mechanical properties within hours after fertilization. Nat Commun. 2016 doi: 10.1038/ncomms10809. PMID: 26904963;

2. Meyer D, Kort J, Chen CH, et al. Development and evaluation of a usable blastocyst predictive model using the biomechanical properties of human oocytes. *PLoS One*. 2024 doi:10.1371/journal.pone.0299602