Successful Application Of A Novel Oocyte Viability Test Utilizing Viscoelastic Properties (P-266)

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Study question

Can assessing viscoelasticity of oocytes measured through aspiration predict their quality and developmental potential?

Summary answer

This study demonstrates that a novel device which measures oocyte viscoelasticity prior to ICSI, can effectively determine oocyte quality, providing a safe and reliable method for selecting oocytes with optimal developmental potential.

What is known already?

Oocyte quality is one of the most important determinants for embryogenesis. However, there is no standard nor effective method to determine it. While morphology and biochemical properties have been shown to be important indicators of viability in many cells (1), there is no standardized methodology to perform these analyses on human oocytes. Having a safe, accurate, and objective solution to identify highest-quality oocytes, would maximize reproductive options and potential.

Study design, size, duration

This study employed a novel device to evaluate the correlation between viscoelasticity of mature oocytes prior to ICSI and subsequent development. The device integrated an AI-driven machine learning algorithm, which processed aspiration videos and corresponding pressure values to extract mechanical and morphological features. The safety of the device's aspiration measurements was thoroughly validated. This preliminary study was conducted at a single site with oocytes from 21 consenting patients.

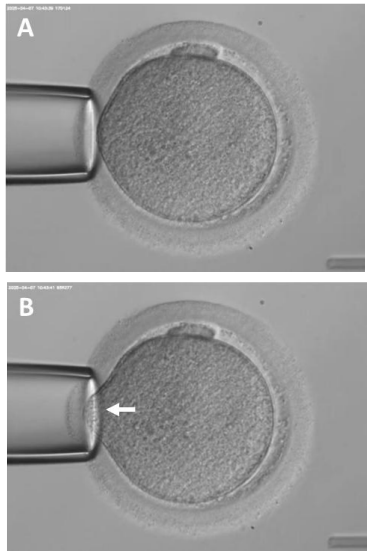
Participants/materials, setting, method

A total of 365 oocytes from patients undergoing in vitro fertilization from 27 to 38 years old (Average age:33.8±2.9) were measured and categorized into three groups: A, B, C. Fertilization rates, day 3 good embryo development rates (≥7CB), and day 5/6 usable blastocyst development rates were compared across the three groups.

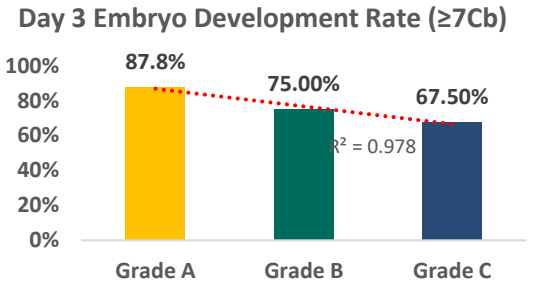
Main Results

The measurement of viscoelasticity did not adversely affect the average fertilization rates (83%), day 3 good embryo development (79.9%), or usable blastocyst development (57.8%), all of which aligned with key performance indicators of the lab. While fertilization rates across groups A (84.8%), B (80.5%), and C (85.1%) showed no significant differences, oocytes graded as A, B, and C achieved day 3 good embryo development rates of 87.8%, 75%, and 67.5% ($p < 0.05$) and usable blastocyst development rates of 64.8%, 54.8%, and 42.5%, respectively ($p < 0.05$). Additionally, our analysis showed that patients under age 35 had higher-quality oocytes, with 54% Grade A, 36% Grade B, and 10% Grade C. In contrast, patients aged 35 and above showed a decline in oocyte quality, with 35% Grade A, 49% Grade B, and 16% Grade C. These findings align with the known decrease in ovarian reserve quality with advancing age.

This study introduces a novel approach to assessing oocyte quality based on viscoelasticity prior to ICSI. Higher-grade oocytes determined by the device were associated with improved embryo quality, higher blastocyst formation rates which would potentially be translated into better reproductive options and outcomes. The device's aspiration measurement had no adverse effects on oocyte development. These findings demonstrate the potential of using viscoelasticity to predict oocyte quality and optimize oocyte/embryo selection.



A. Image before OPAL analysis
B. Image during OPAL analysis
C. Image of OPAL result



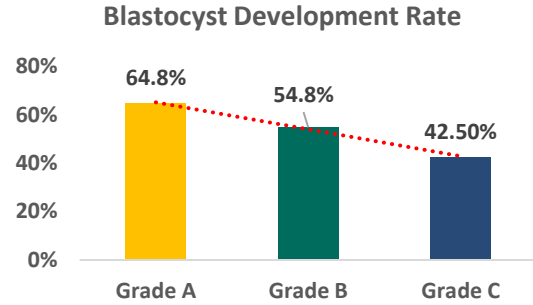


Fig1. Day 3 embryo and blastocyst development rate segmented by OPAL grading.

Limitations and Wider Implication

Larger clinical trials are planned to further validate the generalizability and broader clinical utility of the grading device. This device could potentially be integrated into ICSI workflows, enabling the selection of higher-quality oocytes before fertilization and optimizing reproductive outcomes. It may also aid in identifying superior-quality oocytes before freezing, optimizing the efficiency and utility of oocytes for future reproductive applications.