Noninvasive polarized light microscopy quantitatively distinguishes the multilaminar structure of the zona pellucida of living human eggs and embryos

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Objective: To characterize the architecture of the zona pellucida in living human eggs and embryos, noninvasively with the PolScope, a digital polarizing light microscope.

Design: The PolScope was used to examine zonae pellucidae of living human eggs and embryos.

Setting: Academic IVF clinic.

Patient(s): Patients undergoing fresh, nondonor infertility treatment who underwent egg aspiration, fertilization by intracytoplasmic sperm injection or traditional IVF, and cleavage-stage embryo transfer (day 3).

Intervention(s): The PolScope imaged the zona of eggs before intracytoplasmic sperm injection and in cleavage-stage embryos before transfer.

Main Outcome Measure(s): Thickness and retardance of three zona layers were measured from eight quadrants. Mean and variance in thickness and retardance were calculated for individual eggs and embryos, between eggs and embryos of a cohort, and across the sample patient population.

Result(s): Cleavage-stage (day 3) embryos have thinner zonae (15.2 ± 2.9 μm) than both immature (20.4 ± 2.4 μm) and mature (19.5 ± 2.2 μm) eggs. The zona of embryos is thinner, primarily owing to thinning of the outer layer. The thicker the zona layer, the greater its retardance. Considerable variation exists in the thickness and retardance of zona layers around individual eggs and embryos and between members of a cohort. The zona of eggs and embryos from different patients differ in thickness, retardance, and variation.

Conclusion(s): Thickness and organization of zonae pellucidae of human eggs and embryos varies considerably and can be quantitatively imaged with the PolScope. (Fertil Steril® 2004;81(Suppl 1):850–56. ©2004 by American Society for Reproductive Medicine.)

Key Words: Embryo, human, IVF, egg, polarized light microscope, zona pellucida