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The effect of improved laboratory conditions on aneuploidy rate in human embryos

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INTRODUCTION:
While aneuploidy in human embryos can be as the result of errors in the first meiotic division of the oocyte (which is particularly true for advanced maternal age), exogenous changes in the laboratory environmental conditions – temperature, pH and metabolic stress – can also affect the genetic potential of embryos in culture. Extrinsic culture stressors are controlled to varying degrees in culture systems with advances in incubator technology and improved commercial culture media. However, exposures during oocyte pick-up, denudation of ICSI oocytes, IVF zygote denudation, changeover to extended culture dishes, and handling of embryos during transfer, can also have negative effects on the genome of the embryo.

AIM:
To determine whether improvements in laboratory conditions in the form of controlled environment workstations can decrease the aneuploidy rate of human embryos in culture.

MATERIALS AND METHODS:
A retrospective analysis of genetic testing results was performed to compare aneuploidy rates before and after the introduction of controlled environment workstations (Cell-Tek chambers: Tek-Event, Round Corner, NSW, Australia). Cell-Tek chambers were used during the handling of oocytes and embryos at the following stages: oocyte pick-up, oocyte denudation for ICSI, IVF zygote denudation and extended culture dish changeover. Embryos were cultured in benchtop incubators (Cook MINC and Planer Origio BT37) under low oxygen conditions. LifeGlobal Total medium was used to culture oocytes and embryos in microdroplets under oil. Trophectoderm biopsy was performed on Day 5 using RI Integra 3 micromanipulators with either RI Saturn 5 or Saturn 3 laser systems. Biopsies were performed in a HEPES based medium under oil and trophectoderm samples were tubed at room temperature in a clean laminar flow hood. All biopsied trophectoderm samples were analysed by Genesis Genetics South Africa. Aneuploidy rates were compared using Fisher's Exact Test (MedCalc, see www.medcalc.be).

RESULTS:
Embryos were grouped into the following age ranges: <35, 35–39 and ≥40 years (Groups 1 to 3, respectively) and into sub-groups A (without Cell-Tek; 20/08/2014 – 30/10/2014) and B (with Cell-Tek; 01/03/2015 – 30/05/2015). The aneuploidy rates for sub-groups A and B were as follows: Group 1, 68% v 40% (23/34 v 33/83; $P<0.01$); Group 2, 49% v 53% (23/47 v 35/66, $P=0.706$); Group 3, 85% v 78% (11/13 v 32/41; $P=0.715$). Overall, the aneuploidy rate was higher in the older patients, but in the youngest group there was significantly less aneuploidy when the oocytes and embryos were handled in a Cell-Tek.

CONCLUSION/DISCUSSION:
While no clear benefit was seen in older patients, these results do show that some of the aneuploidy seen in ART embryos – at least in young women – might have been caused by extrinsic stress.
Based on these preliminary findings, and the principle of *primum non nocere*, a controlled environment workstation should be used for all oocyte and embryo handling in the ART laboratory.