Time Lapse Embryo Imaging: We Don’t Wanna Miss A Thing

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For many years, daily assessment of embryo morphology has been the major tool for the embryologist in the selection of the embryo to be transferred. According to a recent consensus reported by Alpha Scientists in Reproductive Medicine and ESHRE Special Interest Group of Embryology, the time points for assessing the embryos after insemination are: checking for fertilization at 17 ± 1 hours, checking for syngamy at 23 ± 1 hours, checking for early cleavage at 26 ± 1 hours post-intracytoplasmic sperm injection or 28 ± 1 hours post-IVF, day 2 embryo assessment at 44 ± 1 hours, day 3 embryo assessment at 68 ± 1 hours, day 4 embryo assessment at 92 ± 2 hours and day 5 embryo assessment at 116 ± 2 hours [1] (Alpha & ESHRE SIG, 2011). As you can see there are huge intervals between the observation time points.

Time lapse imaging means capturing digital images of embryos at set time points [2]. Time lapse softwares use these images to construct videos of embryo development. According to the observations using time lapse imaging, today we know that embryo development is a very dynamic event. The structures (i.e., pronuclei, pronuclear precursor bodies, blastomeres, nuclei of the blastomeres) that form during the embryo development are not static. That is why there are discordances between the studies, which assess the embryos according to their once in a day observations. For example, the events that occur during pronuclei formation and disappearance are not static. They appear as small bodies and they take their largest form before their disappearance. Their alignment changes during development and thus their alignment regarding to the polar body can not be used as a predictive indicator for embryo development. Also, the pronuclear precursor bodies are not static. Their localization changes dynamically during embryo development and thus their alignment can not be used as an indicator for embryo development.

Below are the benefits of time lapse systems and dynamic events, which can be catched or not missed with the aid of the time lapse systems:

In some zygotes, pronuclei appear and disappear earlier than the above mentioned check points. Early pronuclear breakdown is reported to be a good indicator of embryo quality [3]. Using time lapse systems, early pronuclear breakdown can be detected and also 3PN embryos are not missed.

Tripolar cleavage of the zygote or a blastomere, which means cleavage of a zygote or a blastomere to more than two blastomeres can be detected [4] and these embryos can be discarded.

Huge fragments that look like blastomeres can be detected, because these fragments do not cleave and embryo grading can be performed accordingly.

In some zygotes and blastomeres, cleavage does not occur as expected. Abnormal cleavage patterns, in which zygotes or blastomeres attempt several cleavage trials, but can not cleave, can be observed. These patterns may also be indicators of genetical abnormalities.

A normal event during blastocyst formation is the contraction of the blastocoel several times during development [5]. If a blastocyst is observed in the contracted form it can be assessed as not appropriate for the fifth day and can be discarded. Time lapse system is also needed for such situations.

Multinucleation is frequently observed in human embryos [6]. The majority of multinucleated blastomeres are reported to be chromosomally abnormal. However, healthy births are reported to be possible after transfer of embryos containing multinucleated blastomeres [7]. Time lapse imaging makes it possible to catch these multinucleated blastomeres.

Non-sequential time lapse media, which do not need to be replaced are also useful for the embryologist in saving time and reducing workload. Also, time lapse helps the embryologist to save holidays.

Physically removing embryos from the controlled environment of the incubator and stable culture conditions to analyse them for assessment of embryo development and quality under a light microscope in an uncontrolled environment exposes the embryos to stress [8,9].

As a conclusion, time lapse imaging is very useful for selecting morphologically the best embryo. However, we still need further methods for assessment of internal dynamics of embryos.

References

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