Time-lapse imaging

In this issue, the Fertile Battle debate addresses the topic of time-lapse imaging. Whereas sequential visual evaluation of the developing embryo has always been a part of the monitoring process of embryo growth, only recently have commercial interests become involved in the production of equipment that can monitor embryo development autonomously and nearly continuously. At first glance, it seems intuitive that this technological advance would have to be helpful; why move the embryo physically onto a microscope stage if the same observational information can be gathered from a microscope built directly into the incubator? If no harm comes to the embryo, why not simply add built-in microscopes and image recording technology to the rest of the equipment in the in vitro fertilization (IVF) laboratory?

The problem is, of course, that the technology is not cheap. The addition of such equipment to the IVF laboratory can cost hundreds of thousands of dollars. To recoup this investment, most programs are forced to pass the cost on to the patients. To justify the additional cost, a measurable improvement in outcomes would seem to be necessary. In fact, multiple studies have attempted to demonstrate enhanced pregnancy rates as a direct result of time-lapse imaging. However, the technology is still new and evolving, most outcome studies are observational and not well-controlled, and the results remain controversial.

In order to help shed some light on this controversy, this Fertile Battle was crafted by two teams of experts in the field. To help focus the debate, each of the two teams was asked to answer the following questions:

1. Is there robust evidence for the physiologic basis for this technology?
2. What useful information have we gained from the observations of human embryos by time-lapse?
3. Do clinical studies prove that time-lapse has improved outcomes?
4. Can we really extrapolate from the clinical studies to conclude that time-lapse does improve outcomes?
5. Is this a cost-effective use of technology?

The authors of both sides of this topic have done an outstanding job reviewing the literature and presenting data and studies to support their side of the argument. We are thankful to Drs. Reichman and Zaninovich for taking the PRO side of the argument and to Drs. Goodman and Racowsky for presenting the CON side of the debate. It is our sincere hope that the debate format and information presented in this article will help clarify the issues of this intriguing topic.

In retrospect, we may ask ourselves do these questions really represent all of what this debate is about? For example, is it meaningful to ask about the cost-effectiveness of cell phones? Have flat-screen televisions actually been shown to improve the viewing experience? Is time-lapse imaging simply another technological advance that will weave its way into the fabric of IVF so that eventually no one will bother to ask whether or not it was something that we ever actually needed in the first place? Will built-in microscopes and time-lapse image recording simply be a standard feature of the incubator of the future? Technology and convenience do have a way of creating their own demand.

It can be argued that one difference between time-lapse technology and personal cell phones is that the former must be paid for by patients who undergo IVF, whereas the latter is a personal choice made by the individual who pays for the personal benefit of owning and using it. Furthermore, since cell phones can arguably be used by anyone on the planet, the large number of potential users can drive down costs through the function of a free market economy. In contrast, the number of IVF clinics is limited. Furthermore, IVF outcomes are dependent on far too many factors that are not transparent to the consumer, so that we cannot possibly hope that the free market will accurately assess the value and thus dictate the cost of this new technology. Therefore, the controversy will likely continue.

From a purely scientific perspective, there is clearly some information that can be derived from the nearly continuous assessment of the morphological development of the preimplantation human embryo. It seems provocative, for example, to think that the variability in intervals between specific developmental events (such as the timing of cell division) may be reflective of the intrinsic viability or quality of the embryo. It does appear that some developmental parameters at early cleavage stages are associated with subsequent blastocyst development. This finding alone may have a clinical application: if time-lapse could be counted on to accurately predict which embryo will proceed to blastocyst, embryo transfer could be performed on day three, thus sparing the embryo the potentially hazardous additional two days in the incubator while awaiting blastocyst formation. There may be applications that we haven't yet thought of. For example, time-lapse could be used to observe the in vitro development of embryos of other species, potentially revealing similarities and differences in development that we haven't yet appreciated. One thing seems certain: as technology advances, the debate about time-lapse will not remain static. With time and experience, we may well come to quite different conclusions.

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