**Vitrification versus slow freezing embryos before IVF**

Author: Jessica Cornell
Major: Microbiology
Department of Microbiology and Molecular Genetics, Oklahoma State University, Stillwater, OK 74078, USA

**Key Words:**

Slow freezing, vitrification, morphology, cryopreservation

**I**n Vitro Fertilization (IVF) is a form of assisted reproductive technology (ART) that combines an egg from the women and a sperm sample from the man in a petri dish within the laboratory setting. The embryo that develops and divides is then transferred into the uterus of the woman for attachment and growth. The woman can also freeze more of her eggs, so that if the fresh transfer does not take, she has the option of trying again with her leftover frozen eggs. Therefore, the cryopreservation of the eggs is an important and necessary component of the fertilization process, and this study evaluated the success rate, and the morphology of two different types: vitrification and slow freezing.

**Introduction**

Infertility affects about ten percent of women in the United States, which accounts for around 6.1 million women from childbearing years (15-44 years of age) unable to conceive naturally. IVF is an ART that increases a woman’s chance of carrying a child. However, in many cases, the woman’s transfer is not successful. In those cases, they have the option of retrieving one of their frozen eggs to perform another procedural transfer. Before the woman can do that, her eggs must first thaw and become fertilized within the petri dish. There are two different types of cryopreservation: vitrification and slow-freezing.

Slow-freezing was used before vitrification came along. Cryoprotectants is used to prevent the cold temperatures of the freezing process from damaging the cells of the eggs. The study provides information that cryoprotectants are used at low concentrations. This prevented toxicity and osmotic-damage. Although, it did not prevent the formation of crystals, which could affect the overall preservability of the egg. The process of slow freezing the egg is long and expensive because of the specific programming machine that must be used. Preparation for the freezing process of the eggs starts off by incubating the embryos in an equilibrium solution for 10 minutes at room temperature. Three to four embryos are then put into a plastic mini-straw and put into the machine where it goes through a series of temperatures for a series of minutes. When the machine is done, the embryos were kept at -33.0° C for 30 minutes, then put into liquid nitrogen for two months or until time for a second transfer. The cells would have obvious shrinkage. They then would could be stored into liquid nitrogen for at the least two months or until it was time for a second attempt at conception.

In contrast to slow freezing, the study explains that vitrification is inexpensive and non-time consuming. It also uses more concentration of cryoprotectants which prevents the crystals from forming, thus preventing extensive damage to the cells. Preparation for the freezing process of the eggs starts off by incubating the embryos in an equilibrium solution for 5-15 minutes at room temperature. They then were placed into vitrification solution for 50-60 seconds at room temperature. The cells would have obvious shrinkage like that of the slow freezing process. They then would could be stored into liquid nitrogen for at the least two months or until it was time for a second try at conception. Valojerdi and et al, make note that most embryologist use the vitrification method of cryopreserving eggs. However, there has never been a trial study designed to compare the effectiveness of each method. Which is what this study set out to do.

 When the study was over the outcome of 152 slow frozen-thawed embryo transfer cycles. These cycles were from January 2005 up to two years with 153 vitrified embryo transfer cycles from January 2007 for a year and two months at Royan Institute. Each transfer and process was kept constant throughout the study for both methods of cryopreservation

**Recent Progress**

 At the beginning of egg freezing, slow freezing was the only cryopreservation technique accepted and used by infertility specialist and embryologist. With advances in technology and knowledge within the area of reproduction, vitrification was discovered. Continuous studies and experiments showed that vitrification was a successful technique and soon became accepted throughout the field. Researchers in the field are constantly looking for the most advanced and reliable ways to perform and conduct their work. This research varies among different techniques other than slow freezing and vitrification, but it also includes the advancement in those techniques. Both techniques include several steps and mechanics to get to the result, so adding a step or slightly changing a step could potentially make all the difference, and that is what researchers are exploring. Other research is being conducted on the thawing of the eggs because of the outcome it could bring to both techniques. Although studies are being conducted, infertility is a touchy field on ethics, and thus must be careful on how they conduct their studies.

**Discussion**

The results show that the vitrification always lead in each category (survival rate, morphology, pregnancy rate, implantation rate). The survival rate of the embryos that were went through vitrification was 96.9%, whereas the survival rate of the slow-freeze embryos was 82.8%. For morphology, the vitrification embryo had a 91.8% rating. The slow frozen embryos were almost half that at 56.2% rating of good morphology. This could be due to the crystallization that the low concentration of cyroprotectants fails to prevent. The better the morphology, the more likely the embryo will survive once implanted back into the woman. If the morphology of the embryos is good enough to implant into the woman, and the rates of implantation for vitrification was 16.6% and 6.8% for slow frozen embryos. The rate of the implantation taking and the woman becoming pregnant for vitrification was 40.5% versus 21.4% for the frozen embryos.

Other studies like this had the same outcome -vitrification was overall more effective and efficient compared to slow-freezing. The studies agreed that the embryos that were frozen through vitrification had better implantation rates along with pregnancy rates (16.6% and 40.5%) compared to those that were slow-froze (6.8% and 21.4%). The rate of the embryo attaching to the uterine wall, and the woman becoming pregnant did not consider the reason the woman was having to go through IVF, though. Different reasons for infertility can account for why the embryo transfer was unsuccessful. It also could have to do with the morphology of the embryo. If it did not have strong morphological characteristics, the likelihood of success is low.

Couples who attempt to conceive naturally and fail turn to fertility specialist to assist them. Fertility help varies in cost, but IVF transfer is one of the costliest, and can add more stress onto a couple than what the infertility problems had already produced. Stress has shown to alter the hormone levels in a woman’s body which can influence the success of the IVF treatment. Results can range from misconception to miscarriage. That is an important factor to include in this study because it helps emphasize the emotional and physical toll infertility takes on a woman trying to conceive. Thus, finding an affective and useful way to freeze eggs while sustaining good morphological characteristics is a vital influence on reproductive endocrinology. This study’s overall results show that with the more successful rates of vitrification, compared to that of the slow-freezing process, it is the most efficient cryopreservation of embryos for IFV transfers in women today.

**References**

#### "Infertility | Womenshealth.Gov." womenshealth.gov. N. p., 2017. Web.

#### 9 Feb. 2018.

Rezazadeh Valojerdi, Mojtaba et al. “Vitrification versus Slow Freezing Gives Excellent Survival, Post Warming Embryo Morphology and Pregnancy Outcomes for Human Cleaved Embryos.” *Journal of Assisted Reproduction and Genetics* 26.6 (2009): 347–354. *PMC*. Web. 9 Feb. 2018.