

An Overview on the Recent Developments in *In Vitro* Fertilization Techniques

Kenzemed Akar*

Department of Obstetrics and Gynecology, St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

ABSTRACT

In Vitro Fertilization (IVF) has revolutionized the field of reproductive medicine since its inception in the late 1970s. Since the birth of Louise Brown, the world's first "test tube baby" in 1978, IVF has evolved significantly, offering new avenues to overcome infertility and broaden the horizons of family planning. The past few decades have witnessed a multitude of groundbreaking developments, from improved hormonal stimulation protocols that enhance egg production to more precise techniques for embryo selection. One notable advancement is the rise of Preimplantation Genetic Testing (PGT), which allows for the screening of embryos for genetic abnormalities before implantation, reducing the risk of genetic disorders and increasing the chances of a successful pregnancy. Additionally, the emergence of cryopreservation techniques has extended the viability of eggs and embryos, offering greater flexibility in family planning. Furthermore, advancements in laboratory technology, such as time-lapse imaging and artificial intelligence applications, have enhanced the monitoring of embryo development and selection processes, increasing the chances of selecting the healthiest embryos for transfer.

Keywords: Implantation; Pregnancy; Eggs

ABOUT THE STUDY

Preimplantation Genetic Testing (PGT)

One of the most remarkable developments in IVF is the advent of Preimplantation Genetic Testing (PGT). PGT involves screening embryos for genetic abnormalities before implantation in the uterus. This technique allows for the selection of embryos with the highest potential for a healthy pregnancy, reducing the risk of genetic disorders and miscarriages. PGT comes in two main forms:

PGT-A (Aneuploidy screening): This tests for chromosomal abnormalities, which are a leading cause of miscarriages and birth defects. By selecting embryos with the correct number of chromosomes, the chances of a successful pregnancy are significantly increased.

PGT-M (Monogenic disorder screening): This screens for specific genetic mutations that can lead to hereditary diseases. Couples with a known genetic predisposition can use PGT-M to prevent these disorders from being passed on to their children.

Time-lapse imaging

Time-lapse imaging technology has transformed the way embryos are monitored during IVF. Traditional IVF methods involved removing embryos from the incubator for periodic checks, which can potentially harm their development. Time-lapse imaging allows continuous monitoring without disturbing the embryos. With time-lapse imaging, a series of photos are taken at regular intervals, providing valuable information about the embryo's growth and development. This data helps embryologists select the healthiest embryos for implantation, improving IVF success rates.

In Vitro Maturation (IVM)

In Vitro Maturation is a cutting-edge technique that allows the retrieval and maturation of immature eggs. Traditionally, IVF required mature eggs, but IVM offers new possibilities for women with conditions like Polycystic Ovary Syndrome (PCOS) or those at risk of Ovarian Hyper Stimulation Syndrome (OHSS). IVM allows eggs to mature in the laboratory, reducing the need for hormonal stimulation. This not only makes IVF

Correspondence to: Kenzemed Akar, Department of Obstetrics and Gynecology, St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia; E-mail: kenzeakar@gmail.com

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safer but also reduces the financial and emotional burden on couples.

Artificial Intelligence (AI) in IVF

Artificial intelligence has found its way into the world of IVF, offering improved decision-making and more accurate embryo selection. AI algorithms analyze time-lapse images, identifying patterns that are difficult for the human eye to detect. This assists embryologists in selecting the most viable embryos for implantation, further enhancing IVF success rates.

Freeze-all cycles

Traditionally, IVF involved fresh embryo transfers, where embryos were implanted immediately after fertilization. However, recent research has shown that freezing embryos for future use can result in better outcomes. Freeze-all cycles allow for better synchronization of the embryo with the uterine lining, reducing the risk of implantation failure and improving pregnancy rates.

CONCLUSION

Advancements in *in vitro* fertilization have changed the field of reproductive medicine, offering hope to countless couples struggling with infertility. Techniques like preimplantation genetic testing, time-lapse imaging, *in vitro* maturation, artificial intelligence, and freeze-all cycles have collectively improved IVF success rates, minimized risks, and made the process more accessible. As research and technology continue to evolve, the future of IVF looks promising. With ongoing innovations, we can expect even higher success rates, reduced costs, and increased accessibility, ensuring that more couples can fulfill their dreams of parenthood through IVF. These advancements not only bring joy to families but also contribute to the overall progress of reproductive medicine, providing future generations with a better future.