The scientific world has many controversial methodologies for research including animal testing and genetic modifications. These methods are raising concern due to inaccessibility, as well as unethical practices. In this case, we will be discussing a form of in-vitro fertilization called mitochondrial replacement therapy (MRT), a way to target and replace mutant mitochondrial DNA (mtDNA) for disease prevention in future generations. These mitochondrial diseases affect 1 in every 5,000 people, making it a common diagnosis (Cleveland Clinic, 2023). Mitochondrial replacement therapy is a promising approach that should be available for all suitable candidates due to the common nature of these diseases.

Mitochondrial replacement therapy was designed to prevent the transmission of mitochondrial DNA diseases from the maternal parent to the offspring (National Center for Biotechnology Info, n.d.). If successful, the offspring will inherit healthy mitochondrial DNA from the donor, as opposed to mutated mtDNA from the mother. The goal of MRT is to lower the health risks imposed by these mutated mtDNAs, which it has been proven to do through techniques such as maternal spindle transfer (MST), pronuclear transfer (PNT), and polar body transfer (PBT). These techniques involve the transfer of genetic material before and after fertilization. In a study conducted in England, mitochondrial replacement through PNT resulted in 38% of normal clinical pregnancies (Hyslop, 2025). Because there is no known cure for these diseases, MRT is the next best option for a reduced risk of a mitochondrial disease.

Mitochondrial replacement therapy is also a controversial topic due to the ethical concerns it raises on safety and boundaries of genetic modifications. One concern states that having three genetic parents, the basis of MRT, could cause psychological suffering to the offspring .While there is limited evidence on this subject specifically, study shows that children conceived via gamete donation, another three party process, do not struggle to form self-identity or functional relationships (Appleby, 2025). Another ethical question raises concerns about the genetic boundaries, and when enough is enough. It can be argued, though, that mitochondrial replacement therapy approaches the bounds, but never crosses them. This is because MRT was designed for disease prevention through a donor, not enhancing specific traits through gene editing.

Alternatively, there are processes similar to MRT for mitochondrial disease prevention including prenatal diagnosis (PND) and preimplantation genetic diagnosis (PGD) . PND can identify abnormalities in offspring through testing, but is not a treatment option like mitochondrial gene therapy. PGD is another in-vitro fertilization method defined as the testing of pre-implantation stage embryos for genetic defects. (National Academies of Sciences, Engineering, and Medicine, 2016). This complex process can assist in the creation of healthy offspring, but it is only accessible for those who have some unaffected embryos. MRT could be accessible to those without healthy embryos, providing a solution to the problem.

In conclusion, mitochondrial replacement therapy advantages outweigh the ethical concerns raised. Currently, there aren’t many alternative options for mitochondrial disease prevention, but there are other techniques to help identify mutated mtDNA. MRT should be a therapy accessible to those in need to reduce the problems caused by these diseases later in life. The ethical concerns currently raised should not be grounds for a reduced quality of living.

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