Mitochondrial replacement therapy (MRT) is a technique that can replace the mutated or diseased mitochondrial DNA in oocytes that are unfertilized. This is a route that women who carry the mutated mitochondrial gene should take to circumvent the risk of passing down the mutation to their offspring without having to search for other options.

Mitochondrial DNA (mtDNA) carries 37 genes that are important for the function of mitochondria as it is essential for producing energy through oxidative phosphorylation. Mitochondrial gene disorders can be best described as mutations in the cytoplasmic DNA that is in the mitochondria. Since the mitochondrial genome is only inherited maternally, mutations in the mtDNA may be passed to the oocyte, which can cause mitochondrial diseases in the offspring. This might make it hard for women who wish to have children of their own without risking the health and safety of their offspring. A way to prevent this can be the use of mitochondrial replacement therapy. There are different techniques that MRT can accomplish. One way is to use the oocyte at its mature stage when it is in the metaphase stage. The meiotic spindles are separated and moved into the cytoplasm of the donated and unfertilized oocyte. This allows for the oocyte to develop and fertilize without having mutated mtDNA. Another way to replace the mtDNA is to use the pronuclear transfer method (PNT), which is done with the pronuclei in the single-celled embryo stage. These two methods are effective in preventing the transfer of mutated mtDNA from mother to offspring, however, there are still certain things that might prevent a mother carrying mutated mtDNA from using MRT.

While MRT is a successful and efficient way to ensure that the offspring does not have mitochondrial diseases, there are other benefits and disadvantages of using this method. Using MRT allows women to have children who are genetically related to them without having to suffer from mitochondrial mutations. This can also prevent passing down the possibility of mitochondrial diseases from generation to generation. There are several disadvantages to consider when looking at MRT. There is a risk of the disruption of some mitochondrial and genome interactions. However, this disruption has not been found to be harmful in humans and some researchers claim that these interactions that may happen to be harmful are improbable. Another thing to consider is the findings of humans having three parents with this method. Since the donor oocyte is being used, it has been found that the contribution of the donor mtDNA is 0.1% of the DNA. A way to avoid this is by using donors that have the same haplotype. Since the long-term risks are still unknown, there are other ways that a woman can have children without passing down the mutated mtDNA. Women can seek the adoption route to avoid long-term uncertainty and to avoid having a genetically modified child. However, this does mean that the child is not genetically related to the mother. Adoption is also more available to aspiring mothers since MRT is not readily accessible due to its ethical concerns.

Mitochondrial replacement therapy is a method that can be used to prevent passing down mitochondrial diseases down generations by using a “clean” donor oocyte. For aspiring mothers who wish to have children who are genetically related to them, MRT is a technique that can provide them with this request. However since the long-term consequences have not yet been verified, women also have the option of adoption to have children.

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