

Exercise training for patients with primary mitochondrial myopathy and the mitochondrial myopathy that we all have, aging.

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Human aging is a multi-factorial process involving inflammation, macromolecular damage, oxidative stress, telomere shortening and mitochondrial dysfunction. Several types of primary mitochondrial cytopathies share phenotypic similarities with the human aging process including; hypoacusis, visual deterioration/retinal degeneration, muscle atrophy, muscle fatigue, and a greater risk of type 2 diabetes. At the cellular level a reduction in mitochondrial capacity and increase in oxidative stress are often observed in both conditions. Endurance exercise training can enhance total mitochondrial mass with an increase in net mitochondrial capacity in skeletal muscle and lowers oxidative stress through an increase in antioxidant enzyme activity/content. Similar effects have been seen in patients with sporadic mitochondrial DNA deletions and mitochondrial DNA point mutations. Patients with sporadic mitochondrial DNA mutations and those with mutations that affect mitochondrial DNA replication show a much lower mutational burden in muscle satellite cells versus mature muscle. The concept of “mitochondrial DNA gene shifting” was documented in patients with sporadic mitochondrial DNA deletions whereas resistance exercise training activated the quiescent satellite cells and “shifted” undeleted mitochondrial DNA into the mature muscle which lowered the overall mutational burden and improved net mitochondrial enzyme capacity. We have shown that resistance exercise training increased mitochondrial electron transport chain enzyme activity and lowered oxidative stress in older adults and have confirmed that satellite cells do not show the usual age associated increase in oxidative stress and mitochondrial dysfunction and are the likely source of mitochondrial DNA shifting in older adult humans following resistance exercise training. It is possible that a combination of resistance exercise training followed by endurance exercise training may be the ideal therapy to prevent or reverse sarcopenia in older adults and studies are currently underway to test this hypothesis.

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