Mitochondrial DNA leakage induces odontoblast inflammation via the cGAS-STING pathway

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Video Byte

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Abstract

Dental caries are the most common health condition worldwide and can progress to pulpitis, a painful dental pulp infection. Odontoblasts at the pulp-dentin interface fight against these conditions by preventing bacterial invasion. In other pathological conditions, mitochondrial DNA (mtDNA)-related cell stress activates the cGAS-STING pathway, which contributes to inflammation, but whether mtDNA and cGAS-STING signaling are involved in caries- and pulpitis-associated odontoblast inflammation is unknown. A recent study used molecular techniques to investigate this possibility in patient tissues and an odontoblast-like cell line. cGAS and STING levels were elevated in human caries and pulpitis tissues, and the levels increased as inflammation worsened. In the cell line, the inflammation-inducing bacterial product liposaccharide (LPS) increased the expression of cGAS-STING pathway proteins, suggesting pathway activation, but silencing STING diminished some inflammation-related changes. LPS also caused mitochondrial damage and mtDNA leakage into the cytosol in odontoblast-like cells. Depletion of mtDNA inhibited LPS-induced inflammatory changes, including cGAS-STING pathway activation, and in STING-silenced cells, mtDNA treatment was sufficient to induce inflammatory changes. Although further experiments in animal models are needed, the findings reveal a new mechanism of LPS-induced odontoblast inflammation and suggest that targeting the mtDNA-cGAS-STING axis could help treat pulpitis.