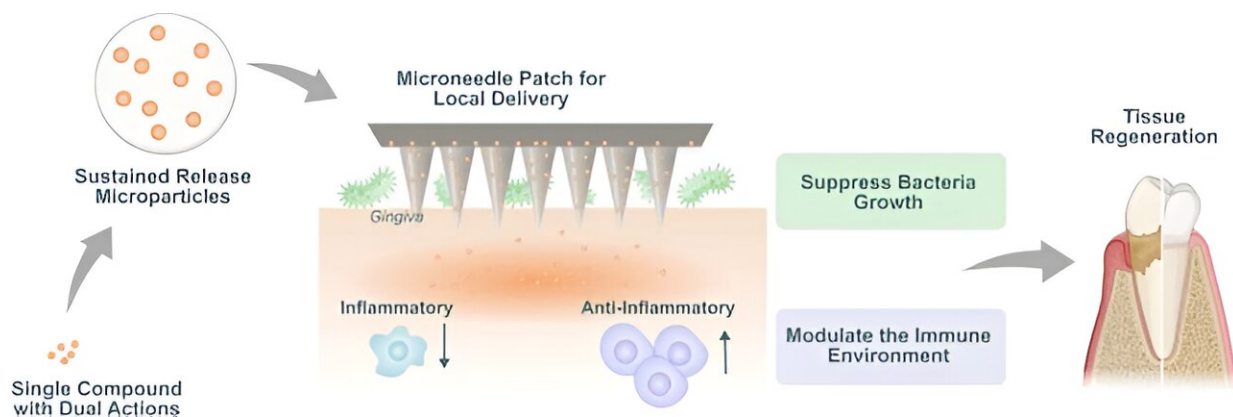


Dissolvable microneedle patch enables periodontal tissue regeneration

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Dual actions of a single compound with both antibiotic and immunomodulatory effects can suppress inflammation and promote tissue regeneration. Fast-dissolving microneedle patch enables minimally invasive and local delivery of biodegradable microparticles as distributive depots for sustained release of therapeutics in diseased tissues. Credit: authors

Periodontitis is initiated by dysbiosis of the oral microbiome. Pathogenic bacteria elicit ineffective immune responses, which damage surrounding tissues and lead to chronic inflammation. Although current treatments typically aim for microbial eradication, they fail to address the significance of immune cell reactions in disease progression.

The team led by Song Li from University of California, searched for

[small molecules](#) as drug candidates and identified a bifunctional antibiotic, azithromycin (AZM), that not only inhibits bacterial growth but also modulates immune cells to suppress inflammation. They further engineered a dissolvable microneedle patch loaded with biodegradable microparticles for local and painless delivery of AZM to the gingival tissues.

The study is [published](#) in the journal *Med-X*.

Inflammatory cytokines were decreased while anti-[inflammatory cytokines](#) and M2 macrophage were increased with AZM treatments in vitro. In vivo delivery of the AZM-loaded microneedle patch demonstrated the same effects on cytokine secretion and the promotion of tissue healing and bone regeneration.

In addition, microparticles containing anti-inflammatory interleukin-4 alone or in combination with separately-formulated AZM microparticles, had similar or slightly enhanced therapeutic outcomes respectively.

The bimodal action of AZM obviates the necessity for separate antibacterial and immunomodulatory agents, providing a practical and streamlined approach for clinical treatment. The use of a microneedle delivery system enhances the targeted and painless administration of the therapeutic agent to the gingival tissue.

The dual action of AZM in suppressing [bacterial growth](#) and modulating immune responses demonstrates its potential as a comprehensive therapeutic strategy for periodontitis. These findings provide a basis for further research and potentially pave the way for the development of novel and effective treatment options for this prevalent oral disease and more chronic inflammatory diseases.

More information: Xuexiang Zhang et al, Dissolvable microneedle

patch enables local delivery of immunomodulatory microparticles containing bifunctional molecules for periodontal tissue regeneration, *Med-X* (2024). [DOI: 10.1007/s44258-024-00023-5](https://doi.org/10.1007/s44258-024-00023-5)

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