

Biological Response of Fibroblasts to Laser-Treated Titanium Surfaces: A Systematic Review

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OBJECTIVE



Laser surface modification has gained increasing interest as a strategy to improve the biological performance of titanium implants and promote soft tissue integration. This systematic review evaluated the influence of laser-modified titanium surfaces on fibroblast adhesion and related cellular responses.

METHODS



Databases

PubMed, Scopus,
Embase,
Web of Science (WoS)



Search strategy

(laser) AND (fibroblast)
AND (titanium)
AND (implant OR disc)
AND (proliferation OR adhesion)



427

records identified



27

studies included
after screening



Low risk of bias

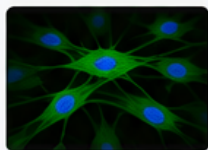
in all included
studies

RESULTS



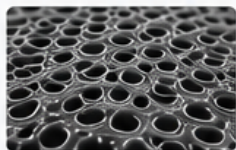
Enhanced Fibroblast Response

Laser-treated titanium improved adhesion, spreading, elongated morphology and metabolic activity.



Favorable Surface Topographies

Micro- and nanotopographies promoted adhesion, proliferation and alignment while reducing bacterial adhesion.



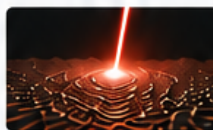
Increased Wettability

Improved surface wettability further supported fibroblast attachment.



Laser Parameters Matter

Biological response was strongly influenced by laser irradiation parameters. Optimized protocols produced more favorable outcomes than insufficient exposure.



Application Technique

Three-directional laser irradiation achieved the highest fibroblast adhesion.



Erbium Lasers

Er:YAG and Er,Cr:YSGG lasers improved fibroblast attachment without compromising titanium surface integrity.



CONCLUSION



Current evidence indicates that laser modification of titanium surfaces positively influences fibroblast adhesion and may improve peri-implant soft tissue integration. The effectiveness of this approach depends largely on optimizing laser parameters to generate surface characteristics that support favorable cellular responses while preserving titanium surface integrity.



Co-funded by
the European Union

FUNDING

This work was co-funded by the European Union under grant agreement No. 2024-1-PL01-KA220-HED-000251208.

DISCLAIMER

Co-Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Foundation for the Development of the Education System (FRSE). Neither the European Union nor FRSE can be held responsible for them.

