

Laser isolation of circulating tumor cells in liquid biopsy

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Abstract

Background

The isolation of circulating tumor cells (CTCs) with high cell viability for further multi-omic analysis and organoid generation is a turning point in modern oncology. In recent years, CTCs and CTC clusters research have completely changed the roadmap of disruptive translational technologies in oncology, mainly because if adequate CTC isolation without cell modification could be achieved in liquid biopsies, it would mean a paradigm shift in clinical and preclinical oncology.

Objective

In this paper, we present a proof of concept for CTC isolation using Blister Actuated Laser Induced Forward Transfer (BA-LIFT). This novel approach to isolate single CTCs from enriched blood samples utilizes a liquid laser transfer (LLT) process adapted to standard laser direct write techniques.

Methods

To completely protect the cells from direct laser irradiation, we use a UV laser to create a bubble-activated laser-induced forward transfer (BA-LIFT) process. By using a plasma treated polyimide layer for blister generation, we completely shield the sample from the incident laser beam. The optical transparency of the polyimide allows direct cell targeting using a simplified optical setup in which the laser irradiation module, standard imaging, and fluorescence imaging share a common optical path. Peripheral blood mononuclear cells (PBMCs) were identified by fluorescent markers, while target cancer cells remained unstained.

Results and conclusions

As a proof of concept, we were able to isolate single MDA-MB-231 cancer cells using

this negative selection process, demonstrating that the technique is not only valid for isolation and further single cell sequencing for multiomic analysis, but also for cell culture of CTCs, which opens the possibility of using them to study tumor biology and generate new patient-derived models.

Refs.

Molpeceres C, et al. Laser transfer for circulating tumor cell isolation in liquid biopsy. Int J Bioprint. 2023, 9 (4), 720. <https://doi.org/10.18063/ijb.720>

Ethics approval and consent to participate

The human study protocol was approved by Comité de Ética de la Investigación con Medicamentos (CEIm), Hospital General Universitario Gregorio Marañón.

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Do you have any conflicts of interest?

No, I do not have a conflict of interest.