Deformation of single cells - Optical two-beam traps and more

An optical two-beam trap composed from two counter propagating laser beams is an interesting setup due to the ability of the system to trap, hold, and stretch soft biological objects like vesicles or single cells. Because of this functionality, the system was also named the optical stretcher by Jochen Guck, Josep Kaas and co-workers almost 20 years ago. In a favorable setup, the two opposing laser beams meet with equal intensities in the middle of a fluidic channel in which cells may ow past, be trapped, stretched, and allowed to move on, giving the promise of a high throughput device. Yet, single beam optical traps, aka optical tweezers, by far outnumber the existing optical stretchers in research labs throughout the world. The ability to easily construct an optical stretcher setup in a low-cost material would possibly imply more frequent use of the optical stretching technique. Here, we discuss advantages and disadvantages of choice of material and methodology for chip assembly and chip production. For high throughput investigations of stretching deformation of single cells, optical stretching is, however, out-performed by hydrodynamic deformability assays. As we will discuss, injection molded polymer chips may with advantage be applied both for optical stretching and for hydrodynamic deformability experiments.

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