wrinkles disappear on detachment of cells from the substrate and a flat surface is restored [1]. One suspects, however, that substrate elasticity will be incomplete and deformation not entirely linear. A non-wrinkling substrate together with embedded microspheres could enable direct measurement of elastic horizontal deformations, albeit at discrete locations [4]. Another possible complication is the overlap of the cell body and intra- and extra-cellular particulate matter in the middle of a wrinkle, which would invalidate the phase difference calculation. One must therefore make judicious choices of location for valid implementation of the force measurement procedure outlined above.

4. Conclusions

The traction forces exerted by fibroblasts cultured on a silicone rubber substratum have been visualized as an elastic distortion and wrinkling by DH-QPM. The traction force has been measured as ~4×10^{-3} dyn/cell based on the degree of wrinkling determined from phase information. The basic principles of DH have been applied to quantitative imaging of wrinkles on silicone rubber due to cell adhesion and motility. The approach is sensitive to cellular forces and it can detect and quantify variations in force within the adhesion area of a cell over time. DH-QPM is shown to be an effective approach for measuring the traction forces of cells.

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