Screening between normal and cancer human thyroid cells through comparative adhesion studies using the Quartz Crystal Microbalance

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Introduction

In this study\textsuperscript{1}, we examined the potential of Quartz Crystal Microbalance with dissipation monitoring (QCM-D) as a diagnostic tool of Anaplastic Thyroid Cancer (ATC), by trying to elucidate differences between the adhesion pattern of normal (Nthy) thyroid and anaplastic (ARO) thyroid cancer cells. The initial hypothesis was that cancer cells may exhibit a different adhesion ability, so we decided to exploit possible differences in cell adhesion patterns on three surfaces: titanium (Ti), gold (Au) and fibrinogen-coated gold (Fg-Au). In parallel, scanning electron microscopy (SEM) images were used to possibly correlate the morphology of cells on these surfaces with acoustic measurements.

Thyroid cell adsorption isotherms

Adsorption isotherms of Nthy and ARO cells on Ti (A), Au (B) and Fg-Au (C). Average frequency values are plotted versus cell concentration. The adsorption pattern of both cell lines obtained on each surface is the same: a higher acoustic response is observed on Ti surface, followed by adhesion to Au and last to Fg-Au.

Cell adhesion kinetics

The rates of frequency shift are plotted as a function of cell concentration. In general, the adhesion kinetics is similar for Ti and Au surface (A & B), while for the Fg-Au surface (C) the adhesion is much slower (Ti = Au >> Fg-Au).

Adhesion patterns and thyroid cell discrimination

Cell morphology upon adhesion to various surfaces was observed via SEM. Nthy cells have bigger diameter and occupy a larger spreading area (with many protrusions) than ARO. ARO cells form fewer contact points with the substrate and maintain their round shape\textsuperscript{3}.

Conclusions

• QCM-D is a powerful technique for cell adhesion studies
• An acoustic pattern was found for both normal and tumor thyroid cells
• The combination of two surfaces can be used as a working platform for cell screening
• Acoustic measurements can provide information regarding adhesion kinetics and cell morphology
• Advantages of the method: a) label-free, b) fast response, c) cost effective and d) discriminating capability between Nthy and ARO

Acknowledgments

The authors would like to acknowledge financial support by the EC under FP7 (ICT Grant agreement No 317742 & REGPOT-InnovCrete grant agreement No 316023).

References


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