Nanodiamond-Mediated Chemotherapy and Imaging

Dean Ho
Division of Oral Biology and Medicine, School of Dentistry
The Jane and Jerry Weintraub Center for Reconstructive Biotechnology
Department of Bioengineering, School of Engineering and Applied Science
California NanoSystems Institute, UCLA
Jonsson Comprehensive Cancer Center, UCLA
10833 Le Conte Ave, Los Angeles, CA 90095

I. Introduction

Nanodiamond-based platforms are promising vehicles for therapeutic release and magnetic resonance imaging due to their uniquely faceted surface characteristics. Nanodiamond-small molecule hybrids have mediated major improvements to therapeutic efficacy and safety. This lecture will highlight recent advancements in the use of both passively and actively targeted nanodiamond-small molecule complexes towards the treatment of multiple forms of cancer both locally and systemically. In addition, diamond-based multimodal magnetic resonance imaging approaches will be explored as potential clinically-significant modalities.

II. Results

Most recently, NDX, a passively-targeted nanodiamond therapeutic agent, markedly improved the pre-clinical treatment efficacy of multiple drug-resistant tumors (e.g. liver and breast) with no apparent myelosuppression, potent drug binding capabilities and the absence of premature/burst drug release [1]. Actively targeted anthracycline delivery has also been demonstrated with resulting tumor regression and enhanced drug tolerance [2]. Nanodiamonds bound to gadolinium have also resulted in injectable contrast agents that are 12 times more efficient than clinical standards with among the highest ever reported per-gadolinium relaxivity values [3].

III. Conclusions

Compounds such as NDX and targeted ND-anthracycline agents are capable of mediating significantly enhanced tumor treatment efficacy and safety as well as drug tolerance compared to clinically-administered standards. Important surface property analysis and the application of additional pre-clinical validation studies that serve as a foundation for the translational development of diamond-small molecule therapeutic hybrids will be discussed.

References

