Dual Stimuli Responsive PEG Based Dendritic Polymers
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Introduction
Thermoresponsive polymers have been designed for wound healing applications. A classic and widely studied thermoresponsive polymer is poly(N-isopropylacrylamide) (PNIPAM) which exhibits a rapid coil-to-globule conversion in aqueous solution around 32 °C. However, there is concern over its safety for in vivo applications. We hypothesise that a PEG based dendritic copolymer with the phase change temperature (LCST) close to body temperature and photo-crosslinkable behaviour that has adequate cell viability can be synthesised via in-situ deactivation enhanced atom transfer radical polymerisation (DE-ATRP)

Materials and Methods
The dendritic PEG-based copolymers were prepared by copolymerisations of poly (ethylene glycol) methyl ether methacrylate (PEGMEMA) and 2-(2-methoxyethoxy) ethyl methacrylate (MEO2MA) with a high concentration of multifunctional vinyl monomer ethyl glycol dimethacrylate (EGDMA) as branching agent via an in-situ deactivation enhanced ATRP. The size, structure and functionalities of the polymer were characterised by GPC, 1H NMR, UV-vis spectrophotometer, FTIR and DLS. Toxicity of the polymer was measured by AlamarBlue® assessment using 3T3 mouse fibroblast cell line.

Results
A thermal and photo sensitive dendritic copolymer PEGMEMA-MEO2MA-EGDMA was synthesised with a high level of branching (10 mol %) and vinyl functional groups (6 mol %), which enables this polymer to be easily modified further. The copolymer exhibited the LCST around 37 °C (Fig.1) and photo-crosslinkable behaviour. AlamarBlue® study indicated that the cell metabolic activity remains unaltered at the polymer concentration of 0.5 and 1 mg/ml (Fig.2).

Discussion and Conclusions
We successfully synthesised a dendritic PEG-based copolymer with desired thermoresponsive and photo-crosslinkable properties. This polymer with the unique structure had acceptable cell viability when studied with mouse fibroblast cells. Additional studies are ongoing to investigate this polymer’s potential in wound healing.

References

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