Gelatin-Methacryloyl within regenerative dentistry

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INTRODUCTION

Approximately 3.5 billion people worldwide are affected by oral disease. Oral health is crucial for overall well-being, including physical and socio-psychological health. Missing teeth can result from trauma or dental conditions such as caries and periodontitis. Currently, tooth loss is often treated with dental implants. However, due to its age-related and non-biological aspects, techniques to regenerate vital tooth tissue are necessary. Therefore, tissue engineering and regenerative medicine are being explored to provide a solution.

MATERIALS AND METHODS

Gelatin-Methacryloyl (GelMA) hydrogel at 5% was prepared by dissolving dry GelMA in PBS at 45°C using a heated magnetic stirrer. After, 0.1% Lithium Phenyl Phosphonate (LAP) photoinitiator was added to the mixture. GelMA was mixed with the cell solution (2 x 10^6 cells) in a 10:1 ratio using a CELLMIXER tool (CELLLINK™). The cell-loaded hydrogel samples were printed using an extrusion-based bioprinter (BioX, CELLLINK™) and cultured for seven days. Cell viability was analysed using a CCK-8 viability assay, while the cytoskeleton was observed using confocal microscopy combined with a DAPI-Phalloidin staining.

RESULTS AND DISCUSSION

This research aimed to evaluate the outcome of various bioprinting parameters while assessing the cell viability of human dental pulp stem cells (hDPSCs) within GelMA. These results showed significant decreases in cell viability from day 1 to day 4, followed by a significant recovery after day 4. This suggests proper cell attachment over time, as confirmed with confocal imaging. Results of the fluorescent staining indicate that the cells are producing more actin filaments after 4 days, implying cells are embedding within the hydrogel. The overall results support the suitability of 5% GelMA hydrogel within applications using hDPSCs.

CONCLUSIONS

GelMA has proven to be a suitable environment for the attachment and proliferation of hDPSCs. Further experiments are needed to refine the bioprinting protocol and to examine osteogenic and odontogenic differentiation possibilities.