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Amoxicillin-loaded PLCL electrospun scaffolds for applications in periodontal tissue engineering

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Background: Destructive periodontal diseases are the leading cause of damage to the supporting structures of teeth. This is the principal cause of tooth loss across the globe. Many of the soft tissues supporting the teeth themselves lack a high standard of regenerative capacity and therefore tissue engineered interventions are investigated to aid this process.

Early failure of implants is often caused by tissue integration issues. Lack of tissue integration is frequently owed to peri-implant infections, delayed wound healing and chronic inflammation. This is especially prevalent in terms of dental interventions due to the environment of diverse bacterial flora in the oral cavity. Therefore, here we investigate the addition of a broad-spectrum antibiotic during the electrospinning process as a preventative measure to reduce the potential for failed integration.

Methods: Electrospun scaffolds encapsulating various concentrations of amoxicillin were produced using a medical grade polymer, Poly (D, L-lactide ϵ -caprolactone), PLCL. Scaffolds were extensively characterised using physical, chemical, and mechanical analyses. Techniques applied include scanning electron microscopy and associated image analysis, Fourier transform infrared spectroscopy, Raman spectroscopy, and tensile testing methods. Drug release from the electrospun scaffolds was investigated using high performance liquid chromatography. Cell viability/proliferation of a model cell line, U2OS, at the increasing concentrations of amoxicillin was investigated using an MTT assay.

Results: SEM analysis showed the encapsulation of amoxicillin within individual fibres in the matrix, demonstrating an increased fibre diameter after the addition of higher concentrations of amoxicillin during the electrospinning process. Increased intensity of Raman peaks validate the incorporation of amoxicillin to the fibre matrix. Mechanical analysis confirms that despite some alterations in properties following the addition of amoxicillin to the scaffold architecture, the scaffolds remain appropriate for tissue engineering of soft periodontal tissues.

The drug release profile describes a burst release, up to 72 hours of incubation. This was followed by a prolonged release, sustained up to 35 days. Investigations of cell viability via an MTT assay confirm that the incorporation of amoxicillin to the scaffolds does not have any cytotoxic effect up to 7 days of culture.

Conclusions: Scaffolds show appropriate properties for use in tissue engineering applications and potential for sustained release following implantation *in vitro*.