

Modelling the Periodontal Defect for Drug Delivery & Regenerative Medicine Research

F. Mirvakily*, A. Rawlinson P.V. Hatton & K. Hurrell-Gillingham

Centre for Biomaterial and Tissue Engineering, School of Clinical Dentistry, University of Sheffield, S10 2TA, UK

INTRODUCTION: Periodontitis is a common cause of tooth loss in adults. This is due to the destruction of the supporting tissues of teeth including alveolar bone and connective tissues. Currently available treatments are based on surgical approaches such as open flap techniques or guided tissue regeneration. These are effective in some cases, but evidence for substantial bone regeneration is limited. Bioactive materials including bioglasses, bioglass-ceramics, and calcium phosphate ceramics have been reported for the reconstruction of bones and tissues. *In vivo* data are promising, but this is not always reflected by improved clinical outcomes following treatments.

The aim of this research is to investigate new regenerative therapies that improve upon the currently available treatments for periodontitis. There are however, no sound models of periodontal defects for the evaluation of drug release or cell-based therapies. Therefore the objective of this study was to develop an *in vitro* model and perform pilot drug delivery experiment using potential bone substitutes and scaffold biomaterials.

METHODS: We designed a model of a bone defect 3 mm in depth and 4 mm diameter using cylindrical acrylic moulds based on data from published clinical studies^{1, 2}. *In vitro* drug release from 45S5 bioglass® was investigated using methylene blue dye. 45S5 bioglass® was melt-derived, milled and sieved to obtain particle sizes of (150-425 µm) comparable to commercial Perioglas. The composition was confirmed using X-ray fluorescence spectroscopy (XRF), and the detailed morphology was characterized by scanning electron microscopy (SEM).

RESULTS: Dye release from the bioglass was greatest at early time points, indicating that a “surface burst” occurred before sustained release of much lower level but very slow levels of dye release.

DISCUSSION & CONCLUSIONS: We concluded that the model reported here has great promise for periodontal drug release studies, and it is therefore a significant advance on current approaches based on simple elution from a disc or tablet. Further work will explore cell and tissue engineering approaches.

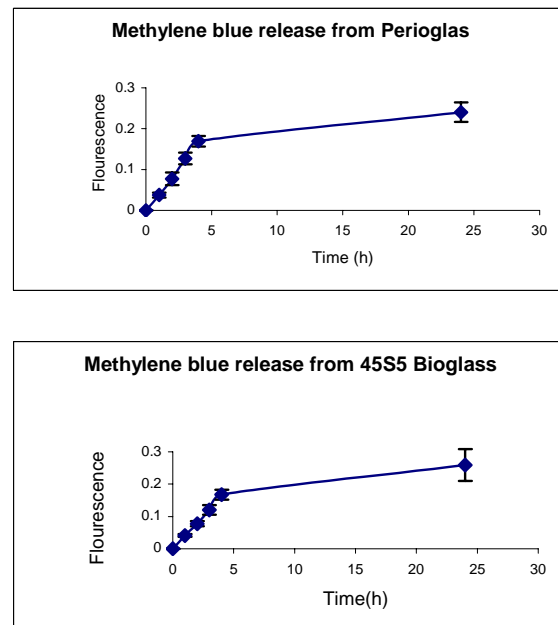


Fig. 1: Comparison of methylene blue release from perioglas (top) and 45S5 bioglass® (bottom)

REFERENCES: ¹Young SJ, Chaibi MS et al (1996) **67**(8): 763-9. ² Becker.W, Becker.BE, Berg L, Samsam C (1986) **57**(5): 277-85