

Biomaterials



This theme area seeks to develop novel biomaterials and tissue engineering approaches for application in dental and broader body organ contexts and to relate their clinical performance to studies of their mechanical and biological properties.

Areas of research

Resin materials development

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In the area of resin materials development, key activities include studies optimising the setting reactions of photoactive resins and resin-based composites using innovative techniques to analyse the change in optical properties, curing light characteristics, mechanical response of nanoparticulate resin composites and resin-modified 'sandwich' restorations.

Cement development

In cement development, our focus is on the generation and characterisation of high-strength bioresorbable calcium phosphate bone cements and their functionalisation as drug release carriers. Other dental and orthopaedic related research is developing durable, rapid-setting, injectable cements for minimally-invasive surgery. Cement-based endodontic sealing materials are also being developed and optimised, including the development of methods for the accelerated setting of mineral trioxide cement aggregates for use in root canal therapy.

Materials-cell/-tissue interactions and tissue engineering

The area of materials-cell/-tissue interactions and tissue engineering spans a range of activities aimed at clinical translation. Our implant integration work has recently been supported by a NIHR Clinician Scientist Award to explore implant driven tissue inflammation in collaboration with the periodontal research group.

This work is complemented by studies on osteoblast responses to micro- and nano-structures and overall this area aims to identify novel diagnostic markers of implant failure and develop implant materials with enhanced biocompatibility. In the bone biology area, studies are investigating the effects of altering the proton density on nanophase hydroxyapatite (HA) surfaces to enhance bone formation and reduce resorption and to determine how HA-based bone substitute graft materials are resorbed in the body.

Collaborative industrial research (funded by Orthopaedic Research UK) is also aimed at developing spring reinforced tissue engineered 'bone-to-bone' ligament replacements. Strategies for promoting osteogenic differentiation of bone marrow stem cells using different materials/processing, eg octacalcium phosphate scaffolds, are also being investigated along with utilising hydrogel tissue technologies and rapid prototyping for the development of next generation bone replacement materials. Hydrogel-based approaches for oral mucosa tissue engineering are also being examined to identify novel clinical delivery methodologies and provide disease relevant models.