Coral reef restoration: the use of novel surfaces engineered with microtopography to optimise coral recruitment

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Coral reefs face multiple level impacts, which contribute to reef degradation. Managing impacts by re-seeding reefs is one option to restore damaged coral reefs, but has relied largely on re-seeding fragmented clones of hard corals. Alternative methods of reef restoration, using larval recruits, has the potential to be effective because thousands of larvae can be sourced from an individual coral. The use of larval recruits can therefore move beyond localised scales of restoration, and reduce the need to destructively collect fragments from adult colonies. Optimising settlement of coral larvae is challenging because settlement is often triggered by a complex range of chemical and physical cues that signal optimal habitats. Previous research has determined the importance of physical surface micro-topography in the larval settlement of marine invertebrates; the theoretical framework of this work is built around Attachment Point Theory. The underlying premise of Attachment Point Theory is that larval attachment is enhanced with increasing availability of attachment points (surface micro-topography) and decreased with fewer points of attachment (flat surfaces). Matching surface micro-topography to larval size can enhance settlement because it reduces the potential of detachment and provides a refuge from indiscriminate predators. Armed with this background, artificial surfaces, engineered with a range of surface micro topographies (circular pits), were used to establish if coral larvae preferentially settled into circular micro pits (200-1000 µm) consistent with their own body size. Experiments using numerous coral species successfully demonstrated the utility of this technology in optimising larval settlement. Importantly, this research established that coral larvae can specifically target micro-pits to settle, and do so without the need for habitat related (chemical) cues. In doing so, artificial surfaces with micro-topography provides a promising method to optimise coral larval recruitment thereby providing seed stock for large scale reef restoration projects.