Femtosecond pulsed lasers for the stimulation of bone cells in bioreactors.

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Background:

We set out to demonstrate how point targeting osteoblast like bone cells with a femtosecond (fsec) pulse laser can induce an up-regulation of bone mineralization *in vitro*. Precise targeting using fsec pulsed lasers might then be used to provide the stimulus or the mechanical strains needed to enhance bone growth or re-growth *in vitro*. We envision that these techniques could potentially be used to sculpture regions where denser bone production is required in tissue bioreactors *in vitro*, or in clinical patients *in vivo.*

Progress to date:

Preliminary results, using quantitative RNA detection techniques (i.e. RT-PCR), investigated Runx2 gene expression in dishes of cells, one week after 100 cells chosen at random were exposed to 500msec point fsec pulsed laser irradiation. Runx2 is one of the genes that become up-regulated when bone mineralization occurs. Early results seem to indicate that there was an up-regulation in Runx2 gene expression 1 week following laser exposure compared to controls (Figure 1).

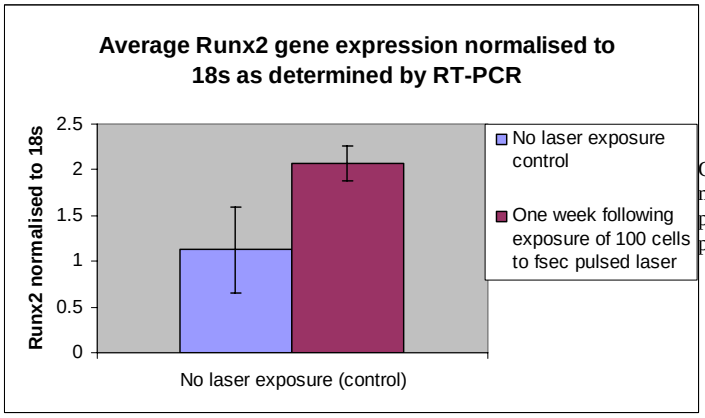

Figure 1

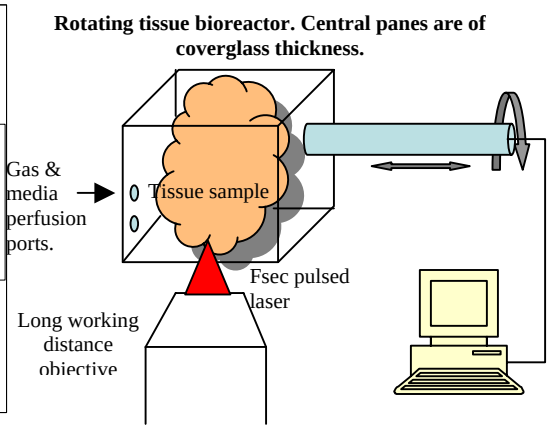

Figure 2

Outcomes:

- Indications are that the use of point targeting with an infra-red femtosecond pulsed laser can provide the mechanical stimulus necessary for bone tissue engineering. This creates the opportunity for the development of a novel *fsec pulsed laser bone tissue bioreactor* for the growth or re-growth of bone tissues (e.g. Figure 2).

Funding is sought to:

- Pursue these multidisciplinary experiments further to determine which genes are up-regulated as a result of point fsec laser targeting of bone cells in culture
- Design and construction of a fsec pulsed laser tissue bioreactor

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