Ultrasound triggered growth factor release – a new approach in bone diseases

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In our steady growing and especially ageing population, the prevalence rate of people suffering from bone disorders is also increasing steadily. Osteoporosis in particular, is one of the frequently occurring bone disorders. Osteoporosis is characterised by low bone density and structural deterioration of bone tissue. It leads to fragile bones with increased risk of fractures which thereby patients suffering from this disease have a decreased quality of life and an increased chance of mortality. Women after menopause and men after an age of 70 fall into the risk group for this disease. The current therapeutic approaches to osteoporosis include orally taken bisphosphonates which inhibit the bone resorption activity of osteoclasts, Selective estrogen receptor modulators (SERMs) which mimic the effect of estrogens, parathyroid hormone for bone formation and denosumab as a specific antibody to inhibit osteoclasts. In our novel approach, we have developed a depot formulation containing bone growth factors which can be triggered by ultrasound. This would lead to a targeted and extended released inside the bone which could help treat bone disorders like osteoporosis. For this purpose, we have prepared an Alginate gel containing bone growth factors crosslinked using Ca\(^{+2}\) ions. Upon application of ultrasound, the gel structure breaks up releasing the growth factors. An added advantage of our system is its “self-healing” effect in which the gel is rebuilt due to the presence of Ca\(^{+2}\) ions and hence the depot system is ready again. A bone model “Zetos” previously described by Davies et.al was used to measure the ultrasound triggered release of growth factors.