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(54) Title: UP-REGULATION OF BONE MORPHOGENETIC PROTEIN (BMP) GENE EXPRESSION IN BONE CELLS BY ELECTROMAGNETIC SIGNALS

(57) Abstract: Methods and devices are described for the regulation of bone morphogenetic protein gene expression in bone cells via the application of fields generated by specific and selective electric and electromagnetic signals in the treatment of diseased or injured bone. By gene expression is meant the up-regulation or down-regulation of the process whereby specific portions (genes) of the human genome (DNA) are transcribed into mRNA and subsequently translated into protein. Methods and devices are provided for the targeted treatment of injured or diseased bone tissue that include generating specific and selective electric and electromagnetic signals that generate fields optimized for increase of bone morphogenetic protein gene expression and exposing bone to the fields generated by specific and selective signals so as to regulate bone morphogenetic protein gene expression in such bone tissue. The resulting methods and devices are useful for the targeted treatment of bone fractures, fractures at risk, delayed unions, nonunion of fractures, bone defects, spine fusions, osteonecrosis or avascular necrosis, as an adjunct to other therapies in the treatment of one or all of the above, and in the treatment of osteoporosis.