High loads of nanohydroxyapatite/graphene nanoribbon composites guided bone regeneration using an osteoporotic animal model

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Abstract

It has been difficult to find bioactive compounds that can optimize bone repair therapy and adequate osseointegration for people with when people osteoporosis. The nano-hydroxyapatite (nHAp) / carbon nanotubes with graphene oxides (GNR) composites have emerged as promising materials/scaffolds for bone regeneration in phase its bioactivity and osseointegration properties. Herein, we evaluated the action of nHAp/GNR composites to promote bone regeneration using an osteoporotic model. First, three different nHAp/GNR composites (1, 2 and 3 wt% of GNR) were produced and characterized. For *in vivo* analyses, 36 Wistar rats (var. Albinus, weighing 250 to 300 g, CEUA n.002/17) were used. Prior to implantation, osteoporosis was induced by oophorectomy in female rats. After 45 days, a tibial fracture was inflicted using a 4.0 mm Quest trephine drill. Then, the animals were separated into 6 sample groups at two different time periods 21 and 45 days. The lesions were filled with 3 mg of one of the above samples using a curette. After 21 or 45 days of implantation, the animals were euthanized for analysis. Histological, biochemical, and radiographic analyses (DIGORA method) were performed. The data were evaluated through ANOVA, Tukey tests, and Kolmogorov-Smirnov tests with statistically significant at $p < 0.05$. Both nHAp and GNR exhibited osteoconductive activity. However, the

nHAp/GNR composites exhibited regenerative activity proportional to their concentration, following the order of 3% > 2% > 1% wt. Therefore, it can be inferred that all analyzed nanoparticles promoted bone regeneration in osteoporotic rats independent of analyzed time.