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Effects of PTH(1-34) during fracture healing after experimental bone drilling in rat femur: novel aspects

Alberto Smargiassi, Marzia Ferretti, Francesco Cavani, Paola Sena, Marta Benincasa, Carla Palumbo

Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy

The study concerns the role of PTH(1-34) during bone lesion repair. 3-month-old male Sprague-Dawley rats, in which trans-cortical holes were drilled at femur mid-diaphysis, were divided in groups with/without Teriparatide administration (40μg/Kg/day), and sacrificed at different times (10, 28, 45 days). In 2002 (1) we demonstrated the occurrence of two successive bone forming processes during both skeletal organogenesis and bone repair, i.e. static (SO) and dynamic (DO) osteogenesis: the former (due to stationary osteoblasts, haphazardly grouped in cords) producing preliminary bad quality trabecular bone, the latter (due to typical polarized osteoblasts organized in ordered movable laminae) producing mechanically valid bone tissue. In brief, the primary function of SO is to provide a rigid scaffold, containing osteocytes (i.e. mechano-sensors), to DO-osteoblastic laminae; therefore, in DO mechanical factors can play a crucial role in transduction of mechanical stresses into biological signals. In the present work, histomorphometric analysis showed that, already after 10 days from drilling, notwithstanding the holes are temporarily filled by the same amount of newly-formed trabecular bone (produced by SO) independently from the treatment, the number of movable osteoblast laminae (typical of DO), covering the trabecular surface, is statistically higher in animals submitted to PTH(1-34) administration than in the control ones; this suggests that the mere effect of Teriparatide is to anticipate the occurrence of dynamic osteogenesis involved in the production of good quality bone more suitable to loading. These findings are also supported by the higher values of microhardness as well as the more ordered-fibered texture (observed by polarized light) in treated animals with respect to control ones that strongly indicates the qualitative (instead of quantitative) effect of PTH (1-34) in improving bone healing. The present investigation could be of crucial importance in further translational clinical research in humans to define the best therapeutic strategies in recovering skeletal lesions, particularly in terms of time of administration of PTH(1-34).

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References

[1] Ferretti et al. (2002) Static and dynamic bone osteogenesis: two different types of bone formation. Anat Embryol 206, 21-29; doi:10.1007/s00429-002-0265-6.

Keywords

Fracture healing; osteogenesis; PTH(1-34).