Can Intermittent Teriparatide Facilitate Supraphysiological-Rate Distraction Osteoegenesis? A Feasibility Study In The Rabbit Tibial Lengthening Model

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Keywords: Distraction Osteogenesis, Teriparatide, Human Parathyroid Hormone, Tibial Lengthening, Animal Model

Background
Distraction osteogenesis gives excellent and reproducible results in limb lengthening and deformity correction. However, the major drawback is the prolonged duration of treatment. Shortening the duration of treatment is one of the greatest challenges, which needs to be addressed. Procedures like lengthening over nail or plate shorten the time to removal of external fixation device, but do not decrease the regenerate consolidation times. Intermittent Teriparatide (human parathyroid hormone) administration has been shown by previous researchers to accelerate and promote bone healing. It has also shown to increase the amount of regenerate and shorten the consolidation phase in distraction osteogenesis.

Objectives
To determine if intermittent teriparatide administration can facilitate acceleration of distraction osteogenesis to supraphysiological rates, without compromising the quality of regenerate.

Study Design & Methods
24 New Zealand white rabbits underwent tibial lengthening of 1 cm by distraction osteogenesis and were divided into 2 groups. Group A (n = 12) underwent DO at the physiological (standard) rate of 0.75 mm per day and Group B (n = 12) underwent DO at supraphysiological (accelerated) rate of 1.5 mm per day. Groups A1 and B1 received intermittent teriparatide whereas Groups A2 and B2 received saline as the vector control. The latency period (7 days) was equal in both groups. The consolidation phase was 2.5 times the distraction phase. The outcome parameters

analyzed included number of failures of DO, total cross sectional area of callus (on microCT scan), bone mineral density and strength as determined by the three-point bending test.

Results

The anabolic effect of teriparatide resulted in 3 times fewer failures as compared to the control group which underwent accelerated distraction osteogenesis. Furthermore, the quality of regenerate, as assessed by total cross sectional area, bone mineral density and mechanical testing was comparable to the 'standard rate' distraction osteogenesis group.

Conclusions

This first of its kind feasibility study has shown that it is possible to accelerate the rate of distraction osteogenesis to supraphysiological levels without compromising on the regenerate quality, by concomitant administration of Teriparatide. However, further animal studies with larger sample size followed by preclinical trials are needed before this concept can be utilized for routine clinical use.