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First clinical application of electric stimulation on human distracted bone

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Abstract:
Skeletal tissue is subjected to several biological and physiological forces that modulate its regenerative responses. Management of skeletal deformities in the maxillofacial region has presented a challenge to clinicians. Successful animal model applications of distraction osteogenesis (DO), also refer to as osteodistraction, in the maxillofacial complex has been extensively reported. DO is a surgical technique that uses the body's own repairing mechanisms as allies for optimal tissue reconstruction and this method has joined the conventional techniques for comprehensive treatment of patients with skeletal insufficiencies. Distraction osteogenesis is known to produce mechanical strains that are transformed by bone cells into electrical signals. In accordance with that, several animal studies suggested that the application of electric current may stimulate bone cells to form new bone. In this study, we report the first clinical application of electric stimulation on human distracted bone. Six adult patients underwent segment transfer distraction osteogenesis of mandibular defects combined with the application of direct electric current. We hypothesized that osteodistraction accompanied with electrical stimulation, will make higher speed feasible without compromising bone quality. Direct current of 10 µA was started at 7 days postoperatively and continued throughout activation and consolidation periods with a rate of distraction at 2mm per day. The distracted and control non-distracted sides were compared during latency, activation and consolidation periods at 1, 3, 6 and 12 month post operatively. Clinical examination, ultrasonography, digital plain radiographs, bone densitometry and computed tomography demonstrated marked increase in bone density of the distracted bone during the distraction process, at the end of consolidation period and surprisingly the distracted bone demonstrated higher densities compared to control. In conclusion, electric stimulation was an effective method to enhance bone formation in mandibular osteodistraction cases. These data suggests that electric stimulation during osteodistraction may be a good modality to shorten the time needed for distraction osteogenesis and to insure high bone quality during distraction process.

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This abstract is a Human Clinical Study. : True

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