

In Vivo Assessment of Bone Healing following Piezotome® Ultrasonic Instrumentation.

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Source

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Abstract

PURPOSE:

This pilot study evaluated the molecular, histologic, and radiographic healing of bone to instrumentation with piezoelectric or high speed rotary (R) devices over a 3-week healing period.

MATERIAL AND METHODS:

Fourteen Sprague-Dawley rats (Charles River Laboratories International, Inc., Wilmington, MA, USA) underwent bilateral tibial osteotomies prepared in a randomized split-leg design using Piezotome® (P1) (Satelec Acteon, Merignac, France), Piezotome 2® (P2) (Satelec Acteon), High-speed R instrumentation, or sham surgery (S). At 1 week, an osteogenesis array was used to evaluate differences in gene expression while quantitative analysis assessed percentage bone fill (PBF) and bone mineral density (BMD) in the defect, peripheral, and distant regions at 3 weeks. Qualitative histologic evaluation of healing osteotomies was also performed at 3 weeks.

RESULTS:

At 1 week, expression of 11 and 18 genes involved in bone healing was significantly ($p < .05$) lower following P1 and P2 instrumentation, respectively, relative to S whereas 16 and 4 genes were lower relative to R. No differences in PBF or BMD were detected between groups within the osteotomy defect. However, significant differences in PBF ($p = .020$) and BMD ($p = .008$) were noted along the peripheral region between P2 and R groups, being R the group with the lowest values. Histologically, smooth osteotomy margins were present following instrumentation using P1 or P2 relative to R.

CONCLUSIONS:

Piezoelectric instrumentation favors preservation of bone adjacent to osteotomies while variations in gene expression suggest differences in healing rates due to surgical modality. Bone instrumented by piezoelectric surgery appears less detrimental to bone healing than high-speed R device.