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Comparative Effectiveness of Vertical Ridge Augmentation Techniques for Dental Implant Treatment: A Systematic Review

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Abstract

Background: Dental implants placement in long-standing edentulous areas often encounter the problem of alveolar height deficiency from gradual bone resorption over time. Therefore, vertical bone augmentation prior to implant placement would be much needed.

Objectives: To compare the effectiveness of various vertical ridge augmentation techniques.

Methods: This review followed the PRISMA guideline. Electronic and manual searches of randomized controlled trials (RCTs) were conducted through the MEDLINE, CENTRAL, Embase, and Scopus databases. The primary outcome was vertical bone gain. Secondary outcomes were bone resorption, complications, implant survival, and success rates. The Cochrane risk-of-bias assessment tool version 2 was used for quality assessment.

Results: Data analyses of the 29 included studies indicated that distraction osteogenesis (DO) provided the highest final vertical bone gain (8.38±1.74 mm.) followed by inlay bone grafting (2.69±0.37 to 7.00±1.76 mm) and guided bone regeneration (GBR) (1.50±1.60 to 6.86±0.94 mm). The highest degree of bone resorption was observed with onlay bone grafting (0.60±0.70 to 4.77±1.67 mm). The DO and GBR techniques demonstrated 20-60% and 0-47% complication rates, respectively. Implant survival and success rates for all ridge augmentation techniques were over 90% and 60%, respectively.

Conclusions: From this study, all vertical bone augmentation techniques can effectively increase the alveolar ridge height. While DO provides the greatest vertical bone gain, the GBR techniques might be a more clinically practical option. However, future well-planned RCTs to identify effective vertical bone augmentation techniques are still warranted.

Keywords: distraction osteogenesis, guided bone regeneration, inlay graft, onlay graft, systematic review