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[Intervention Review]

Interventions for replacing missing teeth: horizontal and vertical bone augmentation techniques for dental implant treatment

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ABSTRACT

Background

Dental implants require sufficient bone to be adequately stabilised. For some patients implant treatment would not be an option without horizontal or vertical bone augmentation. A variety of materials and surgical techniques are available for bone augmentation.

Objectives

To test whether and when augmentation procedures are necessary and which is the most effective technique for horizontal and vertical bone augmentation.

Search methods

The Cochrane Oral Health Group's Trials Register, CENTRAL, MEDLINE and EMBASE were searched. Several dental journals were handsearched. The bibliographies of review articles were checked, and personal references were searched. More than 55 implant manufacturing companies were also contacted. Last electronic search was conducted on 11 June 2009.

Selection criteria

Randomised controlled trials (RCTs) of different techniques and materials for augmenting bone horizontally or vertically or both for implant treatment reporting the outcome of implant therapy at least to abutment connection. Trials were divided into two broad categories: horizontal augmentation and vertical augmentation techniques.

Data collection and analysis

Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted independently and in duplicate. Authors were contacted for any missing information. Results were expressed as random-effects models using mean differences for continuous outcomes and odd ratios for dichotomous outcomes with 95% confidence intervals. The statistical unit of the analysis was the patient.

Main results

Thirteen RCTs out of 18 potentially eligible trials were suitable for inclusion. Three RCTs (106 patients) dealt with horizontal and 10 trials (218 patients) with vertical augmentation. Since different techniques were evaluated in different trials, only one meta-analysis could be performed. When comparing whether vertical augmentation procedures are advantageous over short implants, a meta-analysis of two

trials resulted in more implant failures odds ratio (OR) = 5.74 (95% confidence interval (CI) 0.92 to 35.82; borderline significance, P = 0.06) and statistically more complications OR = 4.97 (95% CI 1.10 to 22.40) in the vertically augmented group. When comparing various horizontal augmentation techniques (three trials) no statistically significant differences were observed. When comparing various vertical bone augmentation techniques (eight trials) no statistically significant differences were observed with the exception of three trials which showed that more vertical bone gain could be obtained with osteodistraction than with inlay autogenous grafts (mean difference 3.25 mm; 95% CI 1.66 to 4.84), and with a bone substitute rather than autogenous bone in guided bone regeneration (mean difference 0.60 mm; 95% CI 0.21 to 0.99) in posterior atrophic mandibles, and that patients preferred a bone substitute block than a block of autogenous bone taken from the iliac crest (OR = 0.03; 95% CI 0.00 to 0.64; P = 0.02).

Authors' conclusions

These conclusions are based on few trials including few patients, sometimes having short follow-up, and often being judged to be at high risk of bias. Various techniques can augment bone horizontally and vertically, but it is unclear which are the most efficient. Short implants appear to be a better alternative to vertical bone grafting of resorbed mandibles. Complications, especially for vertical augmentation, are common. Some bone substitutes could be a preferable alternative to autogenous bone. Osteodistraction osteogenesis allows for more vertical bone augmentation than other techniques which on the other hand can allow for horizontal augmentation at the same time. Titanium screws may be preferable to resorbable screws to fixate onlay bone grafts.

PLAIN LANGUAGE SUMMARY

Interventions for replacing missing teeth: horizontal and vertical bone augmentation techniques for dental implant treatment

Some patients may have insufficient bone to place dental implants but there are many surgical techniques to increase the bone volume making implant treatment possible.
Short implants appear to be more effective and cause less complications than conventional implants placed in resorbed lower jaws (mandibles) augmented with bone from the hip or bone substitutes (cow bone blocks). Bone can be regenerated in a horizontal and vertical direction using various techniques, but it is unclear which techniques are preferable, and complications especially for augmenting bone in a vertical direction are frequent. Some bone substitutes may cause less complications and pain than taking the own bone from various parts of the body.