

# Intervention for replacing missing teeth: Alveolar ridge preservation techniques for dental implant site development - evidence summary of Cochrane review

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## Abstract

The Cochrane reviews have transparent reporting of the methodology to clarify the reader the methods used for writing the review; hence, each review becomes a large volume of scientific literature. This evidence summary of the Cochrane review published in 2015 for the question, what are the clinical effects (preservation of both width and height of bone, esthetic outcomes, complications, and failure of implant) for different alveolar ridge preservation techniques (ARP) and materials used in patients planning implant placement following extraction after 6 months follow-up. This review provides evidence for efficacy of different ARP techniques, materials, and superiority of one over the other. It also tries to settle the controversy of timing of placement of implant after grafting. Of the 8 included studies from 50, two trials provide moderate evidence for xenografts versus extraction favoring xenografts in preserving the width and height of bone by 1.97 mm (2.48–1.46) and 2.60 mm (3.43–1.76), respectively in pooled estimates of meta-analysis. Using different material, five-trial were found; of which, two trials provide moderate evidence for alloplast versus xenografts favoring alloplast in preserving the width by 0.44 mm (0.90–0.02) and low-grade evidence for height of bone by 0.35 mm (0.86–0.16) in pooled estimates of meta-analysis. There is a paucity of randomized controlled trial to address other primary and secondary outcomes addressed in this review.

**Key Words:** Alveolar ridge preservation, evidence summary, implant placement

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## INTERPRETING SUMMARY OF FINDING TABLE IN COCHRANE REVIEW

The Cochrane reviews can answer short or broad questions and have transparent reporting of the methodology to clarify the reader the methods used for writing the review; hence, each

review becomes a large volume of literature. There are few must read and know areas in a Cochrane review; one such table is the summary of finding (SOF) table of the main comparison to

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quickly know the evidence reported from the review when the reader has less time to read all the results of the review.<sup>[1]</sup> It is usually presented up front in the review after abstract and plain language summary. These tables provide the reader the summary of most important outcomes for the single or multiple interventions based on the reviews question. It contains the following: (1) Important outcomes for the main comparison, (2) assumed risk of control group, (3) corresponding intervention group risk, (4) effect measures such as relative risk (risk ratios) or means difference based on the results of the randomized controlled trial (RCT) at 95% confidence interval (CI), (5) number of participants, and (6) graded quality of evidence along with the comments from the author. The relative risk or risk ratio is the ratio between the risk in intervention group and in control group (before the intervention). CI must be narrower around the effect estimates, and broader reflects chance occurrence. The quality of evidence is graded based on the GRADE (Grading of Recommendations, Assessment, Development and Evaluation- using GRADE Pro GDT software) and gives a judgment on the quality of evidence as high, moderate, low, and very low for each outcome in the intervention to make informed decisions.<sup>[2]</sup> It also means that if it is high-quality evidence – further research is very unlikely to change the findings of the review; moderate-quality – further research is likely to have an important impact on our confidence in the estimate and may change the estimate; low-quality –further research is very likely to have an important impact and very likely to change the results of the estimate; very-low-quality – uncertain about the estimates. Blank space indicates information, is not relevant. Whenever the SOF tables state anything below high-quality evidence, then there is a definite need for further primary research in that area to do high-quality RCT for that research question posed by that Cochrane review to improve the quality of evidence from moderate or low to high. The Cochrane reviews are updated every 2 years, and the new trial gets added in the updated review, may change the quality of evidence reported later. This is the only way ahead to improve quality of care for our patients.

## REVIEW BACKGROUND DESCRIPTION

Alveolar ridge preservation (ARP) is the procedure of arresting or minimizing the alveolar ridge resorption following extraction for future prosthodontic treatment including implant placement. The different ARP techniques used routinely are grafting of human (autograft and allograft), bovine (xenograft) or Synthetic (alloplast) with and without the use of different barrier membrane. Barrier membrane may either be resorbable or non resorbable membrane.

## CLINICAL QUESTION

The broad question posed in this review is – what are the

clinical effects (preservation of both width and height of bone, esthetic outcomes, complications, and failure of the implant) for different alveolar ridge preservation technique (ARP) and materials used in patients planning implant placement following extraction after 6 months follow-up.<sup>[3]</sup>

- Problem/patients – in patient planning delayed implant placement following extraction
- Intervention – different ARP techniques and materials
- Control – extraction or other different methods of ARP
- Outcomes – preservation of both width and height of bone, esthetic, complications, and failure of implant.

## REVIEW METHODS -DESCRIPTION

This review finds the evidence for efficacy with different ARP techniques, materials, and superiority of one over the other. It also tries to settle the controversy of timing of placement of implant after grafting. The studies were searched up to 22 July 2014 in electronic data bases (Cochrane library, MEDLINE, EMBASE, LILAC, web of science, Scopus, Proquest, major trial registries), and hand searched, 321 records were identified and screened for review title and abstract based on the inclusion and exclusion criteria, 50 of which were eligible were assessed and reviewed by full text, only 8 trials were included and 42 trials excluded of which 21 had <6 months follow-up being the main reason for exclusion. In the eight included studies seven trials had high risk of bias except one with unclear risk of bias. In total, 184 participants and 233 extraction sites were included in the analysis.

### Type of outcomes primary

- Changes in the buccolingual/palatal width of alveolar ridge
- Changes in the vertical height of the alveolar ridge
- Complications (e.g., discomfort, pain, and swelling)
- In need for additional augmentation prior to implant placement
- Esthetic outcomes of future prosthodontics rehabilitation
- Implant failure rate.

### Secondary outcomes

- Peri-implant marginal bone level changes
- Changes in probing depth (PD) at teeth adjacent to the extraction site
- Changes in clinical attachment level (CAL) at teeth adjacent to the extraction site
- Prosthodontic outcomes of rehabilitation.

## SUMMARY OF KEY EVIDENCE

There are two main intervention in this review one different ARP techniques with different material combinations used to compare or to extraction alone (No ARP was performed)

Table 1: Available evidence for alveolar ridge preservation technique-Grafting versus extraction

Objective (intervention-primary or secondary outcomes)	Number of included studies	Independent variable (experimental-control groups)	Dependent variable-outcomes	Risk of bias in studies (internal validity)	Heterogeneity	Overall weighted-pooled effect estimate from meta-analysis	Grade-approach for quality of evidence	Available evidence
Xenograft versus extraction-change in width of the ridge	2-Barone 2012 Festa 2013	Xenograft versus extraction	Change in width of the ridge	Barone-high risk of bias Festa-unclear risk of bias	None as I square value was less	Mean difference 1.97 (2.48-1.46) at 95% CI	Moderate quality	Good evidence-as the mean difference of 1.97 mm favors xenograft compared to extraction in alveolar width preservation
Xenograft versus extraction-change in height of the ridge	2-Barone 2012 Festa 2013	Xenograft versus extraction	Change in height of the ridge in mm	Barone-high risk of bias Festa-unclear risk of bias	None as I square value was less	Mean difference 2.60 mm (3.43- 1.76) at 95% CI	Moderate quality	Good evidence-as the mean difference of 2.60 mm favors xenograft compared to extraction in alveolar height preservation
Xenograft versus extraction-need for additional augmentation prior to implant placement at 7-36 months	1-Barone 2012	Xenograft versus extraction	Need for additional augmentation prior to implant placement	Barone-high risk of bias		Risk ratio 1.30 (0.75-2.24) at 95% CI	Low quality	Evidence not conclusive-need further research
Xenograft versus extraction-implant failure at 7-36 months	1-Barone 2012	Xenograft versus extraction	Implant failure at 7-36 months	Barone-high risk of bias		Risk ratio 1.00 (0.07-14.90) at 95% CI	Low quality	Evidence not conclusive-need further research
Xenograft versus extraction-peri-implant bone loss at 7 months	1-Barone 2012	Xenograft versus extraction	Peri-implant bone loss at 7 months	Barone-high risk of bias		Mean difference 0.02 (0.18-0.14) at 95% CI	Low quality	Evidence not conclusive-need further research
Allograft versus extraction-change in width of the ridge	1-lasella 2003	Allograft versus extraction	Change in width of the ridge	lasella 2003 high risk of bias		Mean difference 1.40 mm (2.80-0.00) at 95% CI	Low quality	Evidence not conclusive-need further research
Allograft versus extraction-change in height of the ridge	1-lasella 2003	Allograft versus extraction	Change in height of the ridge	lasella 2003 high risk of bias		Mean difference 2.20 mm (3.65-0.75) at 95% CI	Low quality	Evidence not conclusive-need further research

CI: Confidence interval

Table 2: Available evidence comparing different grafting materials

Objective (intervention-primary or secondary outcomes)	Number of included studies	Independent variable (experimental-control groups)	Dependent variable-outcomes	Risk of bias in studies (internal validity)	Heterogeneity	Overall weighted-pooled effect estimate from meta-analysis	Grade-approach for quality of evidence	Available evidence
Alloplast versus xenograft-change in width of the ridge	2-Gholami 2012 Patel 2013	Alloplast versus xenograft	Change in width of the ridge	Gholami-high risk of bias Patel-high risk of bias	None as I square value was less	Mean difference 0.44 mm (0.90-0.02) at 95% CI	Moderate quality	Good evidence-as the mean difference of 0.44 mm favors alloplast compared to xenograft in alveolar width preservation
Alloplast versus xenograft-change in height of the ridge	2-Gholami 2012 Patel 2013	Alloplast versus xenograft	Change in height of the ridge in mm	Gholami-high risk of bias Patel-high risk of bias	None-as I square value was less	Mean difference 0.35 mm (0.86-0.16) at 95% CI	Low quality	Poor evidence-as the mean difference of only 0.35 mm favoring alloplast compared to xenograft in alveolar height preservation
Alloplast versus xenograft-need for additional augmentation prior to implant placement	2-Gholami 2012 Patel 2013	Xenograft versus extraction	Need for additional augmentation prior to implant placement	Gholami-high risk of bias Patel-high risk of bias	None-as I square value was less	Risk ratio 1.09 (0.65-1.83) at 95% CI	Low quality	No evidence found favoring either as the as the pooled estimate crosses the line of no difference-need further research
Alloplast with and without membrane-change in width of the alveolar ridge	1-Brkovic 2012	Alloplast with and without membrane	Change in width of the alveolar ridge	Brkovic-high risk of bias		Mean difference 0.43 (0.18-0.68) at 95% CI	Low quality	Evidence not conclusive-need further research
Alloplast with and without membrane-change in height of the alveolar ridge	1-Brkovic 2012	Alloplast with and without membrane	Change in height of the alveolar ridge	Brkovic-high risk of bias		Mean difference 0.38 (0.26-0.50) at 95% CI	Low quality	Evidence not conclusive-need further research
Alloplast with and without cell-binding peptide P-15-change in width of the alveolar ridge	1-Fernandez 2011	Alloplast with and without cell-binding peptide P-15	Change in width and of the alveolar ridge	Fernandez-high risk of bias		Mean difference 0.87 (-1.93-0.19) at 95% CI	Low quality	Evidence not conclusive-need further research
Alloplast with and without cell-binding peptide P-15-change in height of the alveolar ridge	1-Fernandez 2011	Alloplast with and without cell-binding peptide P-15	Change in height of the alveolar ridge	Fernandez-high risk of bias		Mean difference 0.30 (1.38-0.78) at 95% CI	Low quality	Evidence not conclusive-need further research
Alloplast with different particle size-change in width and height of the alveolar ridge	1-Hoang 2012	Alloplast with different particle size	Change in width of the alveolar ridge	Hoang-high risk of bias		Mean difference 0.10 (-0.97-1.17) at 95% CI	Low quality	Evidence not conclusive-need further research
Alloplast with different particle size-change in height of the alveolar ridge	1-Hoang 2012	Alloplast with different particle size	Change in height of the alveolar ridge	Hoang-high risk of bias		Mean difference 0.10 (-1.22-1.42) at 95% CI	Low quality	Evidence not conclusive-need further research

CI: Confidence interval

and other intervention compared different grafting materials alone. In the eight trials included in the review for the first intervention different ARP techniques and materials used only ARP techniques and materials used only ARP technique. Grafting versus extraction were found [Table I]. Of the three trials from the included studies two addressed xenograft versus extraction, extraction, the meta-analyses pooled estimate favors' xenografts. The two trials provide moderate evidence for xenografts versus extraction in preserving the width and height of bone by 1.97 mm (2.48–1.46) and 2.60 mm (3.43–1.76), respectively. One parallel group trial compared allograft versus extraction, with statistical significance favoring allografts.

In the second intervention comparing different grafting materials, five trials were found to address this intervention of the included studies [Table 2]. (a) Alloplast versus xenograft two trials provided moderate evidence for allograft versus xenografts favoring alloplast in preserving the width by 0.44 mm (0.90–0.02) and low-grade evidence for height of bone by 0.35 mm (0.86–0.16) in pooled estimates of meta-analysis. The other outcomes, need for additional augmentation two trials showed no evidence of difference in meta-analysis and implant failure none failed after 12 months, (b) alloplast with and without membrane for change in width and height of bone one trial with high risk of bias favors alloplast alone without membrane, (c) alloplast with and without cell-binding peptide P-15 no statistical significance was seen between groups in one trial addressing this issue for preserving bone height and width, and (d) Alloplast with different particle size no statistical significance was seen between groups in one trial addressing this issue for preserving bone height and width.

### CLINICAL PRACTICE RECOMMENDATION

There is moderate evidence favoring xenograft versus extraction and moderate to low favoring alloplast versus xenograft as there are only two trials addressing both the ARP techniques and materials, results must be used with caution as almost all studies have high risk of bias except one when assessing the risk of bias in included studies (internal validity). There is general agreement that implants can be placed after 6 months of grafting. There is no evidence to state that ARP increased or decreased implant complications or success due to lack of studies with these outcomes.

### FUTURE RESEARCH RECOMMENDATIONS

Many ARP technique and materials done regularly are missing in this review as they are yet to be compared in randomized controlled trail for both the primary and secondary outcome stated in this review. The body of evidence for both interventions found in the eight included studies is moderate to low meaning further primary research in that area are needed to do high-quality RCT for the research question posed by this Cochrane review to improve the quality of evidence from moderate or low to high for all the primary and secondary outcomes. All implantologist can strive to address areas of concern addressed in this review in which lack of evidence for ARP techniques used routinely to preserve bone to improve the quality of care for our patients.

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### Conflicts of interest

There are no conflicts of interest.

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