Guided tissue regeneration for the treatment of periodontal intrabony and furcation defects:
a systematic review
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CRD summary
This review compared physical barriers with surgical controls for periodontal osseous defects. The authors concluded that guided tissue regeneration is consistently more effective than open flap debridement in the gain of clinical attachment and probing depth reduction for intrabony and furcation defects. Given some uncertainty surrounding the methods used in the review process, it is unclear whether the authors' conclusions are reliable.

Authors' objectives
To determine the efficacy of physical barriers compared with surgical controls in patients with periodontal osseous defects, in terms of clinical, radiographic, adverse and patient-centred outcomes.

Searching
The authors searched the Cochrane Oral Health Group's Trials Register and MEDLINE; the search terms were provided. In addition, the Journal of Clinical Periodontology, the Journal of Periodontology and the Journal of Periodontal Research, including reviews of relevant bibliographies, were handsearched up to January 2002. Two manufacturers of GTR devices were contacted for unpublished data.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs), systematic reviews of RCTs, systematic reviews of cohort studies, cohort studies, case-control studies and systematic reviews of case-control studies, were eligible for inclusion. The studies had to have at least 6 months' follow-up to be included. Studies with experimental design problems were excluded. RCTs and cohort studies were included in the review.

Specific interventions included in the review
All studies that included some form of guided tissue regeneration (GTR) involving the placement of a membrane designed to selectively exclude unwanted tissue from repopulating the periodontal wound, either as a test or control intervention, were eligible for inclusion. Among the types of barrier included in the review were: expanded polytetrafluoroethylene (ePTFE) with and without demineralised freeze-dried bone allograft (DFDBA), polylactic acid, polyglycolic acid, human collagen, bovine collagen with and without DFDBA, cellulose plus hydroxyapatite, and pericardium plus bovine porous bone mineral. Some studies used concomitant treatment with antibiotics.

Participants included in the review
Studies of adults aged 21 years or older with a diagnosis of chronic (adult) periodontitis were included in the review. Studies of both intrabony and furcation defects were also included, but were examined separately.

Outcomes assessed in the review
The primary outcome measures for intrabony defects were clinical attachment level gain (CAL), probing depth reduction (PD) and gingival recession reduction. The primary outcome measures for furcation defects were vertical probing attachment level gain (VPAL), horizontal and vertical PD, and horizontal and vertical open probing attachment level gain (OPA). Other outcomes included were bone levels assessed radiographically, oral hygiene efficacy and compliance, complications related to surgical treatment, tooth retention, disease recurrence and patient-centred outcomes.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.
Assessment of study quality
The quality assessment considered examination of randomisation methods, therapist and examiner concealment or masking, split-mouth or parallel design, and limitations on the number of test or control sites per patient. The studies were assigned a level of evidence based on the Oxford Centre for Evidence-based Medicine Levels of Evidence. Only studies with level 1B to 3B evidence were included in the analysis. The authors did not state how the papers were assessed for quality, or how many reviewers performed the quality assessment.

Data extraction
Data were extracted into a predefined form. The authors did not state how many reviewers performed the data extraction. Information about study design, treatment protocol, participant characteristics, clinical outcomes and patient-centred outcomes were extracted. Each study was graded according to its use of advanced flap management techniques to aid primary closure over the physical barrier, and according to the post-operative care participants received.

Datasets of studies that only provided the standard error were modified by estimating the standard deviation. Studies that did not provide standard deviation or standard error values were assigned a standard deviation based on the average standard deviation for the same test or control group of all studies providing standard deviation values.

Methods of synthesis
How were the studies combined?
Treatment outcomes were pooled to produce weighted mean differences. Separate analyses were carried out for intrabony defects and furcation defects.

How were differences between studies investigated?
Statistical heterogeneity was assessed using Cochran’s test for heterogeneity, using fixed-effect and random-effects models. A regression analysis was used to investigate the effects of the flap closure technique, frequency of the post-operative recall care, and timing of barrier removal on the outcomes. The effects of studies that did not provide standard deviation or standard errors values, for which the standard deviation had to be estimated, were investigated.

Results of the review
Eighty-nine RCTs and cohort studies (number of participants unclear) were included in the review. The majority of the studies were RCTs; it was unclear exactly how many of each study design were included.

The majority of the studies did not provide descriptions of methods used for patient selection, randomisation, blinding or allocation concealment.

In studies of intrabony defect, GTR was significantly more effective than open flap debridement (OFD) therapies in terms of CAL and PD (P<0.0001). There was no statistically significant difference between groups for post-treatment recession. However, when only those studies that used advance flap management were analysed, GTR resulted in a reduction in post-treatment recession, relative to OFD.

In studies of furcation defect, GTR was significantly more effective than OFD therapies in terms of VPAL (P<0.0001; heterogeneity statistically significant, P<0.001), vertical PD (P<0.001; heterogeneity statistically significant, P<0.05) and horizontal OPA (P<0.01; heterogeneity statistically significant, P<0.0001). There was no statistically significant difference between GTR and OFD for post-treatment recession.

In the treatment of intrabony defects, no statistically significant differences between different types of barrier were detected, but barrier types might explain some of the heterogeneity observed in the results. In the treatment of furcation defects, the type of barrier did affect the surrogate outcome of VPAL, which was enhanced only by the use of ePTFE and polymeric barriers.

Augmentation of the GTR barrier with a particulate graft improved vertical PD (P<0.05), VPAL and horizontal OPA, but did not enhance any of the intrabony outcomes.
Further analyses were reported.

**Authors' conclusions**
Overall, GTR was consistently more effective than OFD in CAL and PD in the treatment of intrabony and furcation defects.

**CRD commentary**
The authors set out a clear objective at the beginning of the review, and the inclusion criteria were defined clearly in terms of the participants, interventions, outcomes and study design. Relevant sources were searched for studies, and efforts were made to obtain unpublished data. It was unclear whether the search was restricted by language. The authors did not state whether any efforts were made to reduce the risk of bias during the review process. Quality was assessed using appropriate criteria for comparative studies but drop-outs were not reported; poor reporting in the primary studies appeared, however, to limit a full assessment.

Details of the individual studies were presented. A meta-analysis was used to combine data from RCTs and cohort studies, but it was unclear if the unit of analysis was patients or sites. Statistical heterogeneity was assessed and some differences between the studies were investigated. Both clinical and statistical heterogeneity were present across studies, which suggests that the statistical pooling may not have been appropriate in some cases. Given the limitations outlined above, it is unclear whether the authors' conclusions are reliable.

**Implications of the review for practice and research**
Practice: The authors did not state any implications for practice.

Research: The authors stated that future studies should investigate what defect morphologies would benefit most from the use of augmentation material in addition to the barrier in GTR procedures.

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