A cost-effectiveness evaluation of enamel matrix derivatives alone or in conjunction with regenerative devices in the treatment of periodontal intra-osseous defects

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study examined the cost-effectiveness of various treatment techniques for periodontal infrabony lesions, including flap operation, enamel matrix derivatives (EMD) alone, and EMD with other reconstructive devices. The authors concluded that if EMD were indicated, they were more cost-effective with either bioactive glass or bovine bone substitutes than they were alone. The methods were valid, but high uncertainty was found in the results and the authors’ conclusions should be treated with caution.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
This study examined the cost-effectiveness of various treatment techniques for periodontal infrabony lesions, including flap operation, enamel matrix derivatives (EMD) alone, and EMD with other reconstructive devices.

Interventions
EMD were used alone, in combination with various bone grafting materials (autologous bone or bone substitutes), or with different types of membranes (resorbable or non-resorbable), for guided tissue regeneration. Bone substitutes included bioactive glass, bovine bone, bovine bone plus platelet-rich plasma, bovine bone plus porcine membrane, hydroxyapatite, tricalcium phosphate, and demineralised freeze-dried bone allograft (DFDBA). EMD were compared with flap operation. In total, 12 treatment strategies were examined.

Location/setting
Germany/secondary care.

Methods
Analytical approach:
The analysis was based on a decision-tree model, with a one-year time horizon. The authors stated that the analysis was conducted from the perspective of the decision maker seeking to optimise societal resources.

Effectiveness data:
The clinical data were from a published meta-analysis. This study included all the 12 strategies and assessed their treatment effects over one year. Two key clinical endpoints were considered: pocket probing depth and clinical attachment level.

Monetary benefit and utility valuations:
Not considered.

Measure of benefit:
The two benefit measures were the additional millimetres reduction of pocket probing depth and gain in clinical attachment level. Both were derived directly from the clinical analysis. A 3% annual discount rate was applied.

Cost data:
The economic analysis included the costs of the treatment of an infrabony lesion, such as materials (anaesthesia,
surgical instruments, bone grafts, membranes, EMD, and suturing) and reimbursement of the dentist and staff. These costs were derived from official price lists in Germany, except for EMD, substitute bone graft, and membranes, which were based on their manufacturers’ prices. All costs were in Euros (EUR) and a 3% annual discount rate was applied.

Analysis of uncertainty:
A probabilistic analysis was carried out using a Monte Carlo simulation with 50,000 repetitions. Triangular distributions were assigned to each health outcome.

Results
Pocket probing depth: The analysis showed that flap operation dominated EMD plus hydroxyapatite implants, as this was more expensive and less effective. EMD plus bioactive glass dominated EMD plus autogenous bone, EMD plus expanded polytetrafluoroethylene membrane, EMD plus synthetic resorbable membrane, EMD plus tricalcium phosphates, and EMD plus DFDBA.

Costs and benefits were synthesised using the net benefit approach for different willingness-to-pay (WTP) thresholds. The optimal treatment strategy at a WTP threshold of less than EUR 175 per additional mm of pocket probing depth reduction was flap operation. At a threshold between EUR 175 and EUR 375, it was EMD plus bioactive glass. At a threshold between EUR 375 and EUR 400, it was EMD plus bovine bone and platelet-rich plasma. At a threshold above EUR 400, it was EMD plus bovine bone and porcine membrane.

Clinical attachment level: After excluding dominated strategies, for a WTP threshold per mm of clinical attachment level gain, below EUR 150, flap operation was cost-effective. At a threshold between EUR 150 and EUR 450, EMD plus bioactive glass was cost-effective. At a threshold between EUR 450 and EUR 825, EMD plus bovine bone was cost-effective. At a threshold above EUR 825, EMD plus bovine bone and porcine membrane was cost-effective.

Authors’ conclusions
The authors concluded that if EMD use was indicated, EMD in conjunction with either bioactive glass or bovine bone substitutes were more cost-effective than EMD alone. The additional use of platelet-rich plasma or a resorbable membrane was justifiable only with more generous budgets available.

CRD commentary
Interventions:
The selection of the comparators appears to have been valid because all available treatments that included EMD were considered and compared with flap operation.

Effectiveness/benefits:
The clinical evidence came from a published study, which appears to have been a meta-analysis of data from studies identified by a systematic review of treatments for infrabony lesions. The authors did not report the methods of this study and it cannot be fully assessed to determine the quality of the evidence used in the model. The authors stated that some of the studies included in the meta-analysis had small samples and this explained the high uncertainty around the mean estimates. The two benefit measures were those of the meta-analysis, and the authors provided a clear justification for the exclusion of radiographic defect fills as a further outcome; evidence on this measure was not available for all 12 treatments. These outcome measures were specific to the disease and cannot be compared with those of other diseases. The authors acknowledged that they were only surrogates of the final outcomes and other measures, such as tooth survival, would have been more appropriate, but were not available.

Costs:
The perspective was reported to be societal, but only those costs relevant to the German insurer appear to have been included. It was unclear whether other payers, such as patients, bore any of the costs associated with the treatment of infrabony lesions. The unit costs were not reported for each item as the costs were aggregated for each treatment strategy. These costs were derived from official German sources. Different assumptions on the treatment time were made to reflect the average and an increased time. Reflation exercises for other time periods will be difficult as the price year was not clearly stated.
Analysis and results:
The results were selectively presented; only the cost-effectiveness ratios according to the net benefit approach were reported. The uncertainty was appropriately investigated, using a probabilistic approach to consider simultaneous variations in the model inputs. The authors applied conventional discounting to both the costs and benefits, but the time horizon was one year and discounting should not have been required. They stated that their results were specific to the German context, but should be transferable to other situations with a similar cost differences between strategies.

Concluding remarks:
The methods were valid, but high uncertainty was found in the results and the authors’ conclusions should be treated with caution.

Funding
Funding received from the University of Heidelberg, Germany, the Mannheim Research Institute for the Economics of Aging, Germany, and the Higher Education Funding Council for England, UK.

Bibliographic details

PubMedID
20727057

DOI
10.1111/j.1600-051X.2010.01611.x

Original Paper URL

Indexing Status
Subject indexing assigned by NLM

MeSH
Alveolar Bone Loss /economics /surgery; Bone Substitutes /economics; Cost-Benefit Analysis; Decision Trees; Dental Enamel Proteins /economics /therapeutic use; Germany; Guided Tissue Regeneration, Periodontal /economics; Humans; Insurance, Dental; Membranes, Artificial; Meta-Analysis as Topic; Monte Carlo Method; Platelet-Rich Plasma; Treatment Outcome

AccessionNumber
22011000500

Date bibliographic record published
13/04/2011

Date abstract record published
08/06/2011