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Study:

Retention costs of periodontally compromised molars in a German population

Schwendicke, F., Plaumann, A., Stolpe, M., Dörfer, C.E., Graetz, C.

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Relevant background to study:

Periodontal therapy has shown to achieve predictable results in terms of long-term survival of compromised teeth. This predictability, however, may be diminished when these teeth are affected by other influencing factors, such as furcation involvement (FI), bone loss, mobility, endodontic, or prosthetic status, as well as patient-level risk factors. These factors may also affect the cost-effectiveness of long-term supportive periodontal therapy (SPT), although these costs have not been quantified in previous studies.

Study aims:

To quantify the costs per year of long-term tooth retention of periodontally affected molars, and to identify those factors influencing the cost-effectiveness ratio.

Methods:

This is a retrospective cohort study including patients who had received periodontal therapy for moderate to advanced chronic or aggressive periodontitis between 1982 and 1998 at the Christian-Albrechts-University Kiel, in Germany, and who attended regular SPT for ≥ 9 years (3-12 months recall interval). Patients had to present with at least one first or second molar once initial periodontal therapy (T1) was completed.

Costs were calculated based on fee items, according to the German fee structure in the context of a secondary-care setting.

A mixed public-private payment setting was included in the analyses, as most patients (86%) were enrolled in public insurance, although not all items (such as SPT) were covered and these were therefore paid for by the patient. Resources and costs were calculated per tooth; in those cases where services were provided for more than one tooth at the same time (e.g. examination, antibiotics), costs were distributed among all teeth present.

Effectiveness was defined as years of tooth retention from patients' inclusion to extraction or last observation time (censoring).

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JCP Digest | Journal of Clinical Periodontology | 03 | Paper Digest 2016:43 | 2016 series | EFP European Federation of Periodontology

Scientific release from the EFP December 2016

Methods: *(cont'd)*

No cost-effectiveness ratio was calculated for teeth retained after censoring, as costs for this retention were unknown.

The unit of analysis was the tooth. Costs/year were calculated by estimating the total treatment costs (initial or retreatments, and SPT) per year of tooth retention. The association between cost-effectiveness ratio and the following predictor variables was assessed: a) patient level: gender, diagnosis (chronic or aggressive periodontitis), age (in years) at baseline (T0), and self-reported smoking status; b) tooth level: dental arch (mandibular/maxillary), maximum PPD (mm), degree of FI at T1, radiographic bone loss (% of the root length: ≤25%, ≤50% and >50%), and tooth mobility at T0, prosthetic restoration/abutment at T0 (yes/no), root-canal treatment initially present (yes/no), peri-apical lesion at T0 (yes/no).

Univariate analysis of variance (ANOVA) and post-hoc Bonferroni tests were performed to test the influence of the different predictor variables on costs or effectiveness, while their influence on the cost-effectiveness ratio was assessed by means of generalised linear-mixed models. Costs and costs/year were also calculated at patient level. Generalised linear modelling tested the influence of patient-level predictors and maximum FI at T1, as a tooth-level predictor, on the patient-level cost-effectiveness ratios.

Results:

A total of 2.306 molars in 379 patients were included. The mean patient age at T0 was 45.7 years (SD: 10.0), and the overall follow-up was 16.5 years (SD: 6.8).

Provided treatments (mean per year):

- Scaling and root planing: 0.07 (SD: 0.12). This was significantly higher in younger vs older patients, and in molars with PPD ≥ 5 mm.
- Open-flap surgery: 0.04 (SD: 0.11). This was higher in older patients, molars with PPD ≥ 5 mm, mobility, FI-3, or prosthetic treatment at T0.
- Resective surgery: 0.01 (SD: 0.04). These procedures were carried out significantly more frequently to upper molars, molars with mobility grade 3, FI-3, bone loss, endodontic treatment, peri-apical lesions, or prosthetic treatments.
- SPT: 2.49 (SD: 0.12). PPD, bone loss, mobility, FI, and endodontic treatment were associated with a higher number of visits.

Costs per year:

Under the mixed private-public perspective, total and periodontal treatment costs per year and molar were €19.32 (SD: €18.78) and €14.71 (SD: €12.65) respectively. On the patient-level, mean costs per year of follow-up were €137.86 (SD: €370.03). Total periodontal treatment costs increased significantly for molars with PPD ≥ 5mm, mobility, FI, bone loss, endodontic and peri-apical lesions, and number of teeth < 24. At a patient level, there was a significant association between the cost-effectiveness ratio and smoking status (higher in the case of current smokers) and the fact of having at least one molar with FI grade 3.

Predictors of cost-effectiveness ratio:

Total costs per year increased significantly with each mm of maximum PPD, maxillary vs mandibular molars, mobile molars, those with bone loss, endodontic treatment, and periapical lesions at T0. Prosthetically restored molars showed lower annual periodontal costs when compared with non-restored molars.

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Scientific release from the EFP December 2016

Limitations, conclusions and impact:

Limitations:

- The cost estimates apply only to the German healthcare system and may not be easy to extrapolate to other countries or health systems.
- Periodontal treatments did not include regenerative therapies, which may have influenced both tooth retention and the cost-effectiveness ratio.
- Only direct costs were used in the calculation. Other possible costs – such as those derived from affected patients' absence from work or other productivity factors – may also affect cost-effectiveness.
- The sample population comprised highly compliant patients and so the costs of treating patients with irregular SPT attendance may differ.
- Data collection was retrospective and could be partially inaccurate or incomplete.
- The prediction models evaluated parameters assessed at baseline and after initial therapy, thus their predicting value can be tested only after initial therapy and can be influenced by the individual response to treatment.

Conclusions:

Long-term retention of periodontally affected molars requires limited therapy and costs.

Certain tooth-level factors (such as PPD, mobility, FI, or bone loss) and patient level factors (smoking status) have been associated with periodontal treatment frequency and cost-effectiveness.
The expected costs of retaining periodontally affected molars should be taken into consideration when planning the periodontal treatment of each individual patient.

Impact:

- The retention of periodontally affected molars can be successfully achieved with a limited amount of therapy and a limited annual cost.
- While the majority of treatment costs are dependent on the periodontal condition of the tooth, other aspects – such as the endodontic and prosthetic status of the tooth – can influence the cost-effectiveness of the therapy and should therefore be carefully evaluated and considered.
- When planning the periodontal treatment of a patient, the long-term costs derived from the maintenance and retention of teeth can be seen in advance.