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Guest Editorial

# Making the leap from cost analysis to cost-effectiveness

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Cost-effectiveness is increasingly being recognized as an important aspect of the evaluation of dental treatments and interventions (Braegger 2005). Economic analysis of periodontal treatment dates back to a seminal paper by (Antczak-Bouckoms & Weinstein 1987), and more recently, has been a focus of discussion at the 6th European Workshop on Periodontology, where it was recognized that interventions such as supportive periodontal or maintenance care can lend themselves to this method of evaluation (Gaunt et al. 2008, Sanz & Teughels 2008). A paper in this issue of the Journal (Pretzl et al. 2009) examines the cost of supportive periodontal treatment (SPT) and makes comparisons with the cost of prosthetic options for replacing lost teeth. The authors provide both a thorough analysis of the factors that influence those costs and useful data on the cost-effectiveness of SPT. It is timely, therefore, to take the opportunity to review the essential steps required to establish cost-effectiveness that must extend beyond a simple comparison of two or more interventions, in this case, the cost of SPT with the cost of prosthetic replacements.

A treatment that is cost-effective is one for which the benefits of that treatment exceed the costs. The benefits of dental treatment in general include the improved or retained functionality and aesthetics of the natural dentition and the discomfort of treatment (a limitation) as valued by the patient. The different types of economic evaluation namely, cost benefit analysis (CBA), cost-effectiveness analysis (CEA) and cost utility analysis (CUA), vary in the way in which they value these benefits. Cost Benefit Analysis, for example, seeks to attach a monetary value to the benefits (Sugden & Williams 1979) whereas CUA uses a quality-of-life measure such as the Quality Adjusted Life Year (Broome 1993). CEA only seeks to compare outcomes on an appropriate quantitative scale (Gold et al. 1996).

A common mistake in dentistry and other areas of healthcare provision is to make the assumption that the benefits of treatment are simply the costs averted by that treatment (Davies 1973, Crowley et al. 2000). The costs averted by a treatment should always be included, but as a *negative cost*. The importance of assigning costs correctly in an economic analysis has been discussed previously (Birch & Donaldson 1987), with an emphasis on the need to determine the *incremental* cost of treatment, which is:

> [all of the costs arising from and following treatment]
>
> minus
>
> [all of the costs arising from and following the alternative intervention].

Economic analysis should be based on consideration of the incremental cost and incremental benefit of treatment compared with the alternatives (Drummond et al. 2005).

Consider a simple example. It may be cheaper to wait for a car to break down than to have it regularly serviced. The incremental benefit of servicing is mainly increased reliability. A CBA might determine the value of this benefit by seeking the maximum sum a driver would pay to avoid a breakdown. A CEA might simply estimate the number of expected breakdowns if the car is serviced and the number if it is not. The incremental cost of servicing is the cost of servicing the vehicle over its lifetime minus the breakdown costs averted. If the incremental cost is negative (i.e., it is cheaper to pay for regular servicing over the car's lifetime) then servicing is clearly cost-effective; there is no need to value the benefits, but only to ensure that they are positive (the car breaks down less). If the incremental cost is positive, then this needs to be weighed against the value of the incremental benefits. Servicing may still be cost-effective, but only if the increased reliability is worth the extra cost.

In clinical periodontology, the incremental cost of SPT is *all* of the costs associated with treating a patient *minus all* of the costs in the absence of treatment. The main incremental benefit is likely to be the benefit of retaining all or part of the dentition. While there may be some limitations of SPT such as sensitivity of retained teeth, we might conclude that outcomes for the patient after SPT are demonstrably superior to outcomes in the absence of SPT; the incremental benefits are clearly positive.

When the cost of treatment of a tooth (and, or its periodontal tissues) is less than the cost of prosthetic replacement, it is tempting to conclude that SPT is cost-effective. But this comparison is *not* the incremental cost of treatment. To estimate the incremental cost, the

cost of SPT on all affected teeth must be added to the cost of all other procedures on all affected teeth including prosthetic replacement over a period of time (preferably the patient's lifetime). From this, we must subtract the estimate of the costs the patient would incur on these teeth over the same time period if SPT was not provided. Even for a single tooth, it is not clear whether the incremental costs will be positive or negative if the patient opts for a gap rather than a prosthetic replacement.

In the paper by Pretzl et al. (2009), the dataset for SPT was 2249 teeth in 98 patients. The mean patient costs were approximately 1750 euros (based on reported mean cost per tooth of 76 euros). This is equivalent to the cost of one bridge/patient and is clearly cheaper than placing an implant. It may, however, be more expensive than the additional prosthetic work required to replace lost teeth (for whatever reason) with a removable partial denture (based on reported cost estimates of 1650 euros for fixed partial denture, 2050 euros for a single implant restoration and 790–960 euros for a removable denture for 1–12 teeth). There is no certainty that the incremental cost of SPT is indeed negative (patient costs are lower in the long term with SPT) without an appropriate comparison of costs between patients treated with SPT and patients receiving no structured periodontal maintenance.

Provision of a removable partial denture is highly likely to be considered by most patients as being inferior to retaining the periodontally affected teeth. It may or may not prove to be a cheaper option in the long term. If it does not, then SPT is clearly cost-effective. If provision of a denture provides an inferior but cheaper option, then the patient must decide whether the additional benefits of SPT justify the additional costs. It is not possible to deduce whether SPT is cheaper in the long term by comparing the cost of placing a bridge or denture with the cost of SPT on one tooth.

The paper by Pretzl et al. (2009) is valuable as an aid to evaluate the cost-effectiveness of SPT in combination with other published comparisons of patient outcomes with and without SPT, and suitable estimates of the costs of associated dental treatments and the longevity of restorations. Decision analytic modelling (Briggs & Sculpher 1998, Rohlin & Mileman 2000) is an accepted method of combining pertinent cost and outcome data to estimate the incremental cost and incremental benefits over an appropriate timeframe. This might demonstrate that the incremental cost of SPT is indeed negative, or might help to quantify the benefits of SPT for consideration against the incremental cost by the patient. Conducting evaluations in this way and with further consideration and exploration of the issues in applying economic analysis techniques to periodontology will lead to powerful evaluations of periodontal interventions.

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