Author’s response to reviews

Title: Comparison of potential long-term costs for preventive dentistry treatment of postorthodontic labial versus lingual enamel cavitations and esthetically relevant white-spot lesions: A simulation study with different scenarios

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Author’s response to reviews:

Prof. Dr. Michael Knösel

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Dear Prof. Stamm,

we are grateful for the opportunity to improve our revised manuscript entitled “Comparison of potential long-term costs for preventive dentistry treatment of post-orthodontic labial versus lingual enamel cavitations and esthetically relevant white-spot lesions: A simulation study with different scenarios”. Please find a list of the changes made to the manuscript text attached. We hope the revised manuscript meets the standards set by Head and Face Medicine.

Replies to the reviewers’ comments
We are aware of the complexity of the topic of calculating future post-orthodontic treatment costs. Therefore, we are indeed very grateful for every constructive hint or comment that helps us to improve our manuscript.

We would like to thank both reviewers for the time they made to read and comment on some weak or unclear points of our cost calculation model, and would like to address the comments made by the reviewers as follows.

Reviewer #1:

The paper deals with an interesting topic, which has relevance for the decision process regarding orthodontic treatments.

Comment 1

Minor remarks:

1) For calculation of future costs the authors set some premises in terms of future treatments. Thereby, the treatment of labial white spots was supposed to be done with composite restorations. I think that this treatment option goes too far, since only cavitations (and not WSL) should be treated with restorations. By doing this, the authors took the worst case scenario of treatment options for granted.

This aspect should be reconsidered in the calculation. It should be at least reconsidered in the title and conclusion of the manuscript.

Answer:

We agree that a single-surface composite restoration may go too far as a standard restoration of WSL; however, while many WSL remain untreated, some others may receive esthetically orientated care, be it, resin infiltration, abrasion, composite restoration, or even veneers (the latter of these may probably more likely apply for the U.S. than for Europe). It was our idea to keep the cost calculation both simple, and calculable; therefore, we chose the single-surface composite restoration as a method with known long-term survival data (this was necessary for the model; e. g., there are no 10-year or more long-term data for resin infiltration), and one that comes with more or less low costs in comparison to the other methods. We enhance the description of the simplification made by our simulation model as follows:
“The simulation of a standardized one-surface-restoration instead of partial use of multiple-surface composites, veneers, crowns or the option of non-treatment is to be seen as an averaging approach in the setting of this study: While it is obvious that a single-surface composite restoration may outrun the standard treatment of a labial WSL economically, with many WSL remaining untreated, other lesions may receive esthetically orientated care, such as resin infiltration, abrasion, composite restoration, or even veneers. Our simulation It aims at offsetting potential costs for both increasing loss of hard tissues, with subsequent need for re-treatment, and variation in patient’s individual demands: The reason for simulating costs by a rather simple and repetitive treatment of WSL was to raise awareness and to give an estimate for potential follow-up costs, in an attempt to approximate or to compensate for factors that may lower (use of alternative treatments like micro-abrasion or partial or complete non-treatment of WSLs) or raise total costs (compensation for increasing hard-tissue loss with every re-treatment, with subsequent need for more extensive composite restorations, veneers, crowns etc. [7].”

In order to give a rough idea of potential costs, we not only calculated a treatment including restoration of all WSL with composite, but also provided a calculation for treatment of cavitations, only (Table 3, last seven lines). That is, single-surface restoration was intended to provide for a mixed-cost calculation, with some treatments undercutting and some exceeding those costs. Also, different renewal intervals have been considered (Table 4). We are aware that this mixed-cost calculation still has the character of a model or inevitably simplified simulation. However, we also think that this calculation gives a more detailed idea than the previous ‘ballpark’ cost calculation model provided by Yen et al. [5].

We are making the following additions to

- the title:

“Comparison of potential long-term costs for preventive dentistry treatment of post-orthodontic labial versus lingual enamel cavitations and esthetically relevant white-spot lesions: A simulation study with different scenarios”.

- the conclusion:

„Within the limitation of the averaging treatment simulation of a standardized one-surface-restoration instead of partial use of multiple-surface composites, veneers, crowns or the option of non-treatment, the following conclusions are drawn:“

Comment 2

2) I do not really understand the difference between the two following lines in the Tables:

a) Mean total ( ) costs, per patient
b) Mean total ( ) costs, per patients with at least 1 WSL od Cavity...

To my understanding, option a) already includes treatment of a cavity (see line 35). What is the difference between a) and b)? Please clarify.

Answer:

In situation a) [Mean total ( ) costs, per patient], the mean costs were calculated for all patients, including those without any enamel defects, to get an idea of the mean costs in a sample of one million patients, that is, costs for affected and non-affected patients were averaged, while in scenario b) [Mean total ( ) costs, per patients with at least 1 WSL or Cavity...] the restoration costs are calculated for the group of patients affected by at least one WSL or cavitation. That is, the average costs per patients increases in these groups.

We see the potential to be mis-understood here, as this characterizes the worst-case scenario costs that only applies patient groups that are indeed affected, while the overall costs of a one-million population are reflected by situation a).

We are adding the following information to the respective Table 3 and Table 4 lines:

Mean total (WSL + cavitation initial Tx + Re-Tx) costs, for all subjects including non-affected patients, per patient

Mean total (WSL + cavitation initial Tx + Re-Tx) costs, per patient, for restricted to patients with at least 1 WSL and/or cavitation

Mean total (WSL + cavitation initial Tx + Re-Tx) costs, per patient, for restricted to patients with at least 1 cavitation

Reviewer #2:

I would like to thank you for the opportunity of reviewing this article. The topic is surely interesting and I suggest the publication of the work after some minor corrections:

Comment 1

The length of the orthodontic treatment set in the simulation range between 9 and 45 months (approximately a mean of 36 months). The mean length of an orthodontic therapy is 20-24 months and
only a little part of the patient exceeds three years of therapy. This parameter obviously influences the incidence of WSL.

Answer:

There was a need to base the estimated treatment time on the available studies on the subject. It was stated in the discussion that “MB-Tx duration was calculated after parameters reported for lingual appliance treatment [12], and set to an identical, standardized range from 9 to 45 months for both labial and lingual MB interventions”.

We agree that this information given in the discussion is not sufficient, and we extend it as follows:

[MB-Tx duration was calculated after parameters reported for lingual appliance treatment [12], and set to an identical, standardized range from 9 to 45 months for both labial and lingual MB interventions.] The treatment duration in the two reference studies used here [2; 12] was 9-45 months in the case of lingual treatment, while in the conventionally bonded reference study the treatment duration of the sample was given in blocks, with roughly ¼ of treatment durations each under 22 mo; 22-27 mo; 27-33 mo; and +33 months [2]. In order to be able to compare both treatments without bias, the simulated treatment time was set to 9-45 months, thereby providing a 'mixed calculation’ of short and longer interventions: To generate the individual treatment times per patient in a robust and consistent way, a univariate distribution U(9,45) was used to select a treatment time randomly within the interval from 9-45 month. The expected value as well as the Median of this distribution would be 27 months, meaning that approximately 50% of all simulated cases had a treatment duration of less than 27 months. With this approach treatment time variations (longer treatment durations yield a higher risk of WSL incidence) can be taken into account while keeping the average time around 27 months, thereby averaging out the impact of longer and shorter treatment durations when summarized across the simulated patients.

Comment 2

WSL on vestibular side are all considered to be treated with composite restoration. I agree for frontal teeth but not for molars where a white spot could also be monitored, stabilized and not treated with composite.

Answer:

This point was raised also by reviewer #1 as a potential source of misunderstanding.

As stated in the answer to comment #1 of reviewer #1, we agree that a single-surface composite restoration may go too far as a standard restoration of WSL; however, while many WSL remain untreated,
some others may receive esthetically orientated care, be it, resin infiltration, abrasion, composite restoration, or even veneers (the latter of these may probably more likely apply for the U.S. than for Europe). It was our idea to keep the cost calculation both simple, and calculable; therefore, we chose the single-surface composite restoration as a method with known long-term survival data (this was necessary for the model; e. g., there are no 10-year or more long-term data for resin infiltration), and one that comes with more or less low costs in comparison to the other methods. We enhance the existing description of the simplification made by our simulation model as follows:

“The simulation of a standardized one-surface-restoration instead of partial use of multiple-surface composites, veneers, crowns or the option of non-treatment is to be seen as an averaging approach in the setting of this study: While it is obvious that a single-surface composite restoration may outrun the standard treatment of a labial WSL economically, with many WSL remaining untreated, other lesions may receive esthetically orientated care, such as resin infiltration, abrasion, composite restoration, or even veneers. Our simulation study It aims at offsetting potential costs for both increasing loss of hard tissues, with subsequent need for re-treatment, and variation in patient’s individual demands: The reason for simulating costs by a rather simple and repetitive treatment of WSL was to raise awareness and to give an estimate for potential follow-up costs, in an attempt to approximate or to compensate for factors that may lower (use of alternative treatments like micro-abrasion or partial or complete non-treatment of WSLs) or raise total costs (compensation for increasing hard-tissue loss with every re-treatment, with subsequent need for more extensive composite restorations, veneers, crowns etc. [7]).”

In order to give a rough idea of potential costs, we not only calculated a treatment including restoration of all WSL with composite, but also provided a calculation for treatment of cavitations, only (Table 3, last seven lines). That is, single-surface restoration was intended to provide for a mixed-cost calculation, with some treatments undercutting and some exceeding those costs. Also, different renewal intervals have been considered (Table 4). We are aware that this mixed-cost calculation still has the character of a model or inevitably simplified simulation. However, we also think that this calculation gives a more detailed idea than the previous 'ballpark' cost calculation model provided by Yen et al. [5].

We are making the following additions to
- the title:

“Comparison of potential long-term costs for preventive dentistry treatment of post-orthodontic labial versus lingual enamel cavitations and esthetically relevant white-spot lesions: A simulation study with different scenarios”.

- the conclusion:
Within the limitation of the averaging treatment simulation of a standardized one-surface-restoration instead of partial use of multiple-surface composites, resin infiltration, abrasion, composite restoration, veneers, crowns or the option of non-treatment, the following conclusions are drawn:

Comment 3

Authors could also consider resin infiltration technique even if actually there is no study with a long follow-up

Answer:

This is a good idea to consider in a future project; by now, we think it is not viable, simply because the technique of resin infiltration is relatively new, and long-term survival data on a large scale are currently not available (but necessary to base a long-term cost calculation on). Longest follow-up report up until now included 8 patients, with observation times varying between 24 and 43 months:


It was already stated so in the manuscript:

Alternative WSL and cavitation treatment options

(...) No treatment or only partial treatment would be an option, i.e. restricting WSL treatment to e.g. upper and lower incisors or canines. To give an idea about the variation in costs, we calculated scenarios for both care for cavities, only, and cavity plus WSL treatment (Table 3).

There are alternatives to single-surface composite restorations of WSL for treating esthetically relevant enamel areas, such as micro-invasive infiltration. However, no long-term assessments of the esthetic effect of WSL infiltration exceeding one year observation are currently available [22,23]. Moreover, the initial treatment of WSLs by infiltration may be increased compared to composite restorations, due to the higher costs of the infiltrant material [7].

In addition, the Conclusion is enhanced with the information on different alternative treatment options:

Within the limitation of the averaging treatment simulation of a standardized one-surface-restoration instead of partial use of multiple-surface composites, resin infiltration, abrasion, composite restoration, veneers, crowns or the option of non-treatment, the following conclusions are drawn:
Comment 4

Laboratory and patients' fee for the appliance (lingual and vestibular) should be taken in consideration in future studies using German mean fee and costs

No language revision is needed.

Answer:

We were thinking about considering this parameter, too. However during planning of the first preliminary calculations it turned out that this parameter is very difficult to consider, as both treatment and laboratory costs for lingual appliances vary distinctively between the different countries; the same applies for potential additional preventive costs (such as fluoride releasing bracket / enamel smooth surface sealants, brackets and / or archwires that potentially speed up treatment, additional professional dental cleaning appointments etc.), all of which may influence frequencies and severities of post-orthodontic enamel defects. Therefore, it was the idea to calculate the 'naked’ costs and leave it to the clinician or reader to set it in relation to respective local costs for additional measures, be it prophylaxis or lingual treatment expenses. But, it would be an option to calculate costs in a future project including e.g. typical local laboratory costs; however, these data could then be published in a local [German] paper, only, as potential conclusions may not apply for other countries.

Again, we would like to thank both reviewers for the time they devoted to help us in improving our paper.

Kind regards,

Michael Knösel