Toothbrushing efficacy

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Chapter 11

Summary and conclusions
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The efficacy of toothbrushing as underlying topic of this thesis harbours a multitude of areas to focus on. At first glance, toothbrushing may be just the use of a toothbrush to control a healthy situation in the mouth and to prevent caries and gum disease. However, this way of presenting the goal of performing a measure to (re)establish and maintain healthy teeth for life might be just a little bit too easy. There are as many reasons which one can think of to support the use of toothbrushes, 'toothbrush-like-devices' and other products which have in common that they are supposed to be of benefit to the intra oral environment. This benefit is usually considered as clinically relevant if it is able to manage the condition in the mouth to allow the beholder to chew, eat, speak, smile (and kiss) to its full contentment.

Chapter 2, 4, and 5 were all randomized controlled clinical trials and used a brushing episode in order to investigate the efficacy of the respective toothbrushes in terms of plaque removal and other parameters of interest. Within one subject two or more treatment modalities were investigated in order to make paired comparisons. It was shown in chapter 2 that the toothbrush is still the tool to brush with, and that the toothbrush is not yet outperformed by sophisticated microfibers. In chapter 4 it was concluded that new brushes are better in plaque removal than worn brushes. The 'grade of wear' is a better manner than 'time' to decide whether a toothbrush should be discarded and replaced by a new brush. The large variation between different users and their brushing habits, do make brush age inadequate to be used as an indicator for toothbrush replacement. In chapter 5 a multi-level toothbrush removed more plaque than a flat-trimmed toothbrush and it was concluded that a hard brush is not as pleasant in use as a soft brush but it is not less safe. Another conclusion was that the use of dentifrice does not result in higher performance of a toothbrush in terms of plaque removal.

Chapter 3 and chapter 6 can be considered as a kind of cohort studies, with a certain comparison between groups. In the developing country of Myanmar it was shown that school-based toothbrushing programs do not have an effect on gingivitis and plaque scores in children aged between 8 and 11 years old. In order to obtain positive results in the investigated population there is a whole lot more needed than just a toothbrush. In chapter 6 an attempt was made to link soft tissue trauma to gingival recession and to investigate whether there is a difference between manual and powered brushes. For both types of toothbrushes the presence of gingival recession could not be explained by soft tissue trauma as a result of brushing. For the powered brush less gingival abrasion was observed and at the same time lower plaque scores were obtained after a brushing episode. In other words, the powered brush caused less damage and was more effective as compared to the manual brush.

Chapter 7 and chapter 8 are studies of longer duration with the focus on gingival parameters whereby participants are followed for up to nine months. Efficacy differences between a powered and a manual brush in terms of gingival bleeding were investigated in chapter 7. It was shown that in the study population (having moderate gingivitis) the use of a powered toothbrush resulted in a significant
benefit to preventing gingival bleeding to recur as compared to the use of a manual brush. Also, throughout the study duration of 9 months the powered brush was able to demonstrate lower scores with regard to plaque. In chapter 8 the classic experimental gingivitis model was used for a head-to-head comparison of an oscillating-rotating (OR) powered toothbrush and a high frequency powered toothbrush. Participants did not brush their teeth for 3 weeks and subsequently had their gingivae examined for bleeding. In a period of 4 weeks the OR brush was more effective to improve the gingival condition than the high frequency toothbrush. Furthermore, lower plaque scores were obtained by the OR brush. Finally, chapter 9 is a systematic review which aimed to provide a comprehensive overview of selected toothbrushing studies in order to evaluate the effectiveness of a single powered brushing episode by means of percentage plaque score reduction. This resulted in an average weighted mean plaque score reduction of 46%. The large dataset provided opportunities not only to assess the overall effect but also to investigate what factors have an effect on this outcome. It was concluded that, apart from power supply, mode of action, and brushing duration, the index scale to score plaque has a major effect on the outcome.

Given these observed differences, just as a result of the choice which index is to be used, one could discuss which plaque index is best suited for research on oral hygiene products. Grading the indices in terms good, better, best is not the aim of this paragraph but could be topic of a ‘perio-workshop’. Nevertheless, for future research it may seem useful to standardize some aspects of study designs which apparently influence the outcome. Consensus on how data is presented can help to better understand the scientific results which in turn may contribute to better oral health of the general population.

Taken all of the above together the overall conclusion is that at present the toothbrush is the most effective oral hygiene tool available. A toothbrush should be replaced when it shows splaying of its filaments beyond the base of the toothbrush handle. A multi-level toothbrush shows a significant albeit small advantage over a flat-trimmed toothbrush. A powered toothbrush is more effective than a manual brush. An oscillating-rotating powered toothbrush is more effective than a side-to-side powered toothbrush. Toothbrushing with powered toothbrushes results in an average weighted mean percentage plaque score reduction of 46% however this efficacy appears to be related to the index scale to score plaque.

The general population has the opportunity to use fairly good oral hygiene products. However in the light of the relatively limited percentage plaque reduction as mentioned above compliance enhancing methods should be developed that may contribute to better use of the available products.