“Plaque, Sugar, Diabetes and Smoking – Re-assessing Risk Factors”

By Prof. Crawford Bain, UAE

Introduction
Many dentists base their practice on an understanding of various risk factors thought to contribute to the development of dental diseases. It has been taught that Dental Plaque (Biofilm) is the single most important factor in the development of caries and periodontal diseases, the former requiring the added in-gredient of frequent sugar exposure and the latter, if it is to progress to significant bone loss, needing the presence of one or more of complicating factors such as Genetic Susceptibility, Smoking and Diabetes.

Accordingly dental prevention has focused on effective regular plaque removal and a reduction in the frequency of sugar exposure and cigarette use, as well as the overeat- ing/under-exercising combination which predisposes to type 2 Diabetes. Twice daily brushing with a fluoride containing toothpaste combi- ned with regular Interproximal Cleaning, for example, has been widely advocated as effective preventive measures, while twice yearly check- ups have been recommended to fa- cilitate early detection and manage- ment of dental problems. It is therefore the purpose of this paper to re- view the existing justifications for these commonly held beliefs and, whether the scientific evidence and in- cidence based approaches to the effec- tive adoption and ideally prevent- ion of Dental Caries and Periodontal Diseases.

Measuring the Effectiveness of Preventive Measures
Webster’s dictionary describes an OUTCOME as “Something that occurs as a result or consequence of an action” and Surrogate Outcomes to measure ef- fectiveness of preventive treatment interventions. These include a Plaque Index, less bleeding, enamel surface, percentages of bacterial pathogens and reductions in other easily mea- surable variables. A problem exists in indices which assess hard or soft tis- sue as well as the quantity and qual- ity of life. It is therefore necessary to look at what we have.

Dental Caries
There are essentially 2 diseases to consider. Enamel Caries, most com- monly seen only up to the age of 30 years and life, Caries, commonest in the last 30 years of life. From age 30 to 60 we find typical tooth loss; it is uncommon except in extreme cases. Surrogate outcomes include plaque effect, enamel brushing and reduction and replacement of missing teeth.

In a recent systematic review assess- ing the effect of Dental Flossing on interproximal caries it was concluded that “...a 14 day FDI study has failed to show an effect” (1). In lay terms flossing (if performed properly) reduces the proximal decay, although substantial outcomes like plaque indices and bleeding can be improved instantly and in- termittently.

If we cannot, honestly, advocate the use of floss to prevent caries, how about toothbrushing? Fortunately we have a longitudinal study with a 26 year follow up period on the incidence of enamel loss “...brushing at least once a day -49% reduction in odds of tooth loss” (2). There is now also compelling evi- dence that power brushes are more effective than manual brushes in plaque removal and reduction of inflam- mation (3), however, we have to date had a weak to anadequate scientific studies where these results can be extrapol- ated to real outcomes in the long term.

Traditionally the number of sugar exposures per day has been consid- ered important in the initiation of caries lesions (1). Studies support this, Chaushu-Vásquez R. A et al in 2007 examined the “Effect of Flossing on the plaque and Microbiota on Human Enamel” and found a linear dose-response rela- tionship of caries on patients’ teeth (4). Ten volunteers living in a fluoridated area were palatal abrasions bear- ing enamel human slabs for 4 days. Slabs were exposed to 26% sucrose solution either (control, 2, 4, 6, 8 or 10 x x days) and the volunteers used fluoride deoxyribose 3% x 5 times day and photographed the toothbrush on plaque and addi- tionally 22 variables in a multivariate analysis. The results are shown in table 2. Enamel surface damage and enamel lesions have an indication of meta- phenolic Bacterial Plaque. Smok- ing and type 2 Diabetes as major, potentially manageable, periodontal risk factors.

Periodontal Diseases
In a systematic review examining the effect of dental flossing on periodontal disease, the findings with which the Dental and Dental Hygiene professions have focused on “Plaque control” has taken atten- tion away from the important role of other risk factors. It is beyond the scope of this paper but poor oral hygiene and the genetic predisposition to periodontal disea- ses, and at present this appears to be a very important potential risk factor that is not related to the relative im- portance of Bacterial Plaque, Smok- ing and type 2 Diabetes as major, potentially manageable, periodontal risk factors.

Bacterial Plaque
In a systematic review examining the effect of dental flossing on periodontal disease, Buchert et al concluded that the evidence reviewed “...did not show a benefit for floss on plaque and clini- cal parameters of gingival inflamm- ation.” Buchert et al concluded that the evidence reviewed “...did not show a benefit for floss on plaque and clini- cal parameters of gingival inflamm- ation.” Buchert et al concluded that the evidence reviewed “...did not show a benefit for floss on plaque and clini- cal parameters of gingival inflamm- ation.”

On the other hand several studies have shown that thorough tooth brushing alone does not control these same surrogate meas- ures of periodontal health. In an 8 year study of treated perio-dontitis patients, Ramfjord et al 1982, concluded that those with the worst OH did just as well as the quartile with the best OH PREDICTED they had either a good 3% Fluoride varnish applied every 3 months or 3% Amine Fluoride varnish applied every 6 months. The results are shown in table 2. In a longitudinal study of 349 patients followed for 10 years that smokers lost almost twice as much bone as non-smokers over this pe- riod, while a smoker who quit had slowed bone loss than the continuing smoker (5). In a later study Hyman and Reid (2003) assessed loss of attachment – another True Outcome – differen- tiating between younger and older patients and found an OR of 16.6 of loss of attachment – in Smok- ers age 20 to 49. Not surprisingly a Loss of attachment -3mm in Smok- ers age 40 had an even greater OR of 25.6 (4). In a recent controlled study in pre- school children a periodontal surgical treatment reduced the HbA1c levels of the participants by over 1% (7).

According to Diabetes UK, if such a reduction could be sustained in Diabetic patients it might result in a diabetic long term 95% less likely to suf- fer cataracts, 18% less likely to suffer heart failure and 43% less likely to suffer amputation or death due to peripheral vascular disease. Clearly these are enormous potential health benefits.

Discussion
It seems apparent that many of our traditional approaches to preven- tion, while truly well intentioned, have a weak evidence base. It is chal- lenging for any health care profes- sionals to be asked to question the veracity and benefits of a long used set of preventive recommendations that continue to be taught while progressively increase the risk of tooth loss. Furthermore, have we smoked 20 cigarettes a day for 20 years (20 pack/year) they are around 100% more likely to lose teeth due to periodontal disease (OR 6). Smoking cessation should thus be as fundamental to dental prevention as it is for general hygiene instruction.

Table 1: Factors contributing to the increase in root caries

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>1%</th>
<th>3%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>OH1 Only</td>
<td>2.5</td>
<td>1.1</td>
<td>0.9</td>
<td>0.7</td>
<td>0.4</td>
</tr>
<tr>
<td>OH2 &amp; OH1</td>
<td>2.5</td>
<td>1.1</td>
<td>0.9</td>
<td>0.7</td>
<td>0.4</td>
</tr>
<tr>
<td>OH3 &amp; OH2</td>
<td>2.5</td>
<td>1.1</td>
<td>0.9</td>
<td>0.7</td>
<td>0.4</td>
</tr>
<tr>
<td>OH4 &amp; OH3</td>
<td>2.5</td>
<td>1.1</td>
<td>0.9</td>
<td>0.7</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Table 2: Root caries reduction using various topical agents (Tan et al 2010)

In a systematic review and meta- analysis Engberg and Kocher (2019) (6) found a mean treatment effect of a reduction of HbA1c of 0.95% after periodontal treatment and smoking cessation. This is consid- ered equivalent to the type 2 diabetic needing one less drug for glycemic control.

In a recent controlled study in pre- school children a periodontal surgical treatment reduced the HbA1c levels of the participants by over 1% (7).

According to Diabetes UK, if such a reduction could be sustained in Diabetic patients it might result in a diabetic long term 95% less likely to suf- fer cataracts, 18% less likely to suffer heart failure and 43% less likely to suffer amputation or death due to peripheral vascular disease. Clearly these are enormous potential health benefits.

Diabetes
Presław et al in 2012 (7) described both a clear relationship between de- crease in HbA1c level and reduction of periodontitis as well as describing a risk of a potential diabetes mellitus (i.e. and there will desirably be a change in nephropathy combined) which is truly highly associated with diabetes with severe periodontitis than in diabet- ics without severe periodontitis. This major relationship between these 2 major diseases mandates not only effective glycermic control in order to achieve the best outcomes of per- iodontal therapy, but also effective periodontal management to reduce the risk of the severe complications of diabetes.
Developing healthcare professionals of tomorrow

HAMDAN BIN MOHAMMED COLLEGE OF DENTAL MEDICINE
DUBAI • UAE

APPLICATIONS NOW OPEN

MSc in ORTHODONTICS
MSc in PROSTHODONTICS
MSc in ORAL SURGERY

MSc in PEDIATRIC DENTISTRY
MSc in PERIODONTICS
MSc in ENDODONTICS

For more details, please visit: www.mbruniversity.ac.ae
to address the relationship of the various risk factors to Peri-implant diseases and implant failure. In view of the rapid increase in the use of dental implants and the self-evident truth that the vast majority of implant patients lose their teeth due to Caries or Periodontal Disease, it is equally important that dental health care professionals appreciate the relative importance of the risk factors outlined above on Peri-implant diseases. In a very recent extensive retrospective study Derks et al (18) identify moderate to severe peri-implantitis in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined, and report on the Odds Ratios in 14.5% of implant patients examined.

Our understanding of the relative importance of the various major risk factors for Caries and Periodontal diseases should be evidence based and current. At present it is reasonable to conclude the following:

1. Recent research has indicated that the total amount of sugar consumption is more important than the number of sugar exposures per day in the development of coronal caries.
2. There is little to support the use of dental floss as a preventive measure for dental caries or gingivitis.
3. Effective toothbrushing, using a fluoride toothpaste and a power brush, is by far the most effective preventive measure to minimize dental caries and periodontal diseases.
4. To minimize the incidence of root caries in the elderly oral hygiene must be supplemented with periodic application of a fluoride or chlorhexidine preparation.
5. While oral hygiene is important in controlling Periodontitis in the susceptible patient, compliance with a comprehensive Supportive Periodontal Maintenance Recall regimen is likely even more critical in preventing progression and tooth loss due to Periodontitis.
6. To achieve the best outcomes in periodontally susceptible patients who smoke, smoking cessation programs must accompany traditional “Hygiene” phase therapy.
7. To achieve the best outcomes in diabetic patients with Periodontitis, the dental professional must work closely with the medical clinician responsible for diabetes care. Improvements in one disease are likely to be complemented by improvements in the other.

When assessing the relevance of clinical research more credence should be given to longer term studies which use SURROGATE outcomes.

References
5. E. Bernthorst et al J Dent Res Published online before print November 9, 2010.