Management of dental plaque to reduce disease

Dental hygienist Mhari Coxon gives an overview of dental biofilm

Diagram One: Four Stages of Biofilm Cycle. With kind permission of Professor John Thomas, West Virginia University.

Boxed area with Stages

Stage I is the quiescent or least metabolically active state.

Stage II - Conversion or transformation from Stage I to Stage II requires significant genetic up-regulation.

Stage III involves maturity of the biomass, and total organism concentration increases. At this phase, new antigens may be expressed, genetic exchange enhanced and membrane transport maximized.

Stage IV (apoptosis or death) signals detachment, erosion or sloughing from the biofilm.

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Diagram 3: Development of subgingival biofilm. - With kind permission Professor John Thomas University of West Virginia.

Stage Three

Bacterial blooms are periods when individual species or groups of strains grow at a rapidly accelerated rate. More mes-sengers are sent, in the form of quorum sensing, and a second wave of bacterial co-aggregate with bacteria that are already locked to the pellicle.

Stage IV

Dense but perforated cloud-like structures grow up from the enamel surface, acting as sites for new microorganisms.

Once the surface of the tooth has been cleaned, a conditioning film of proteins and glycoproteins is adsorbed rapidly to the tooth surface. This is the salivary pellicle forming and starts immediately after the surface has been cleaned.

The subgingival bacterial colony will detach itself from the tooth and some planktonic bacteria will be released to continue the growth cycle.

The subgingival dental biofilm is still formed mainly of gram-positive cocci and rods with some gram negative cocci and rods. The real change in the production of large numbers of gram negative rods and spirochetes which are either planktonic or attached to the epithelium.

Summary

The first stage is predominately gram-positive cocci and is represented by the streptococcal species, the second stage is cross-linking via fusobacterial species, and the third stage is predominately gram-negative organisms. Mature oral biofilms are highly complex and silent, acting as reservoirs of antibiotic resistance and virulence in deep periodontal pockets. Their uncontrolled growth may lead to eventual periodontal disease.

Micro communities

As the biofilm develops, gram-positive bacteria to one containing significant numbers of gram-negative anaerobes. This amount varies from host to host depending on there predisposition to an inflammatory response.

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Disruption of the biofilm

The key weapon against this maturation is available to periodontists and patients remain regular disruption, and where possible removal of the biofilm and saliva plaque causing a break in the cycle. This tends to inhibit the microbial growth. We know that, if left untouched for up to 12 weeks, pockets will be colonized and so the need for maintenance care remains as valid as it always has.

Adjuncts

Some adjuncts have proven to be helpful in slowing and reducing the cycle of biofilm.

Mouthwashes

Chlorhexidine, Cetyl pyridinium Chloride and Essential oil mix mouthwashes have all shown some penetration into a biofilm of varying percentage in research. These in conjunction with good toothbrushing and interdental cleaning can be useful in the reduction of incidence of the chronic diseases of periodontal disease and dental caries. No antimicrobial can disrupt the biofilm significantly without mechanical intervention.

Photosdisinfection

Photodisinfection system developed by Ordine that utilizes low-intensity lasers and wavelength-specific, light-sensitive, bioavailable to specifically target and destroy microbial pathogens and reduce the symptoms of disease. The compounds are generally topically applied and one or more lasers are used to activate the compounds and complete the disinfection. Research is ongoing in this field.

Probiotics

There was a probiotic launched this year specifically aimed at supporting a health dental plaque. There is some early research available but more in-depth study is needed.

Formation of the dental biofilm

Microbial generally prefer to develop in an attachment (ses-sile) formation. The microorganisms found in the mouth are typically pathogenic to humans. The microbial biofilm environment can thrive as planktonicism found to be pathogenic to transcription. The biofilm then grows primarily through cell division of the already attached bacteria, rather than through the adherence of new bacteria. Next, the proliferating bacteria begin to grow away from the tooth. Plaque doubling times are rapid in this early stage of development.

Dental biofilm

Dental biofilm was described well as ‘a microscopically derived sessile community, characterized by cells that are irreversibly attached to a surface and to each other, are embedded in a microcolony of all other sites in the body. The microbial communities are protected from the environment. These micro colonies are not passively isolated, rather that they work together to create the best environment for themselves and protect the microgroup.

Formation of biofilm can be separated into four stages.

Stage Two

Attachment can be defined as a slime layer forming around the colonizing pioneer bacteria, which consist mainly of gram-positive cocci and rods that divide and form microcolonies.

The initial colonizing bacterium connect to the pellicle and each other with thousands of fine, hair-like structures called fimbrae. Once they stick, the bacteria begin producing substances that encourage other planktonic bacteria to join the community. This is the recruitment phase, it is thought that the act of attaching to the pellicle stimulates the bacteria to excrete an extracellular slime layer that helps to anchor them to the surface and provides protection from the microbes already attached.

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Plaque signals detachment, erosion or sloughing from the biofilm. The key weapon against this maturation is available to periodontists and patients remain regular disruption, and where possible removal of the biofilm and saliva plaque causing a break in the cycle. This tends to inhibit the microbial growth. We know that, if left untouched for up to 12 weeks, pockets will be colonized and so the need for maintenance care remains as valid as it always has.

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This article is intended to give an understanding of the structure of biofilm and its role in periodontal disease. Its role in dental caries will also be discussed.

Introduction

It is without doubt that bacteria, and the bio-products of their life cycle, are the primary etiological factor in the chronic disease of periodontitis.

The bacterium in the mouth can be split into three groups – Planktonic or free floating, those attached to the oral epithelium, and those attached to the tooth or other inert surface. The inter-action of the planktonic and epithelial-based bacteria with the microbes attached to the tooth surface enables the complex biofilm that is dental plaque to develop. It is this plaque that triggers the host’s response, in susceptible persons, causing periodontal tissue degeneration to begin.

Stage Five

Neutrophils and other immune cells then extend into this subgingival biofilm. Gin-gival inflammation does not appear until the biofilm changes subgingival plaque biofilm. Gingival inflammation does not appear until the biofilm changes.

The first stage is predominately gram-positive cocci and is represented by the streptococcal species, the second stage is cross-linking via fusobacterial species, and the third stage is predominately gram-negative organisms. Mature oral biofilms are highly complex and silent, acting as reservoirs of antibiotic resistance and virulence in deep periodontal pockets. Their uncontrolled growth may lead to eventual periodontal disease.

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Micro communities

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Discordance

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Sonic toothbrushes

Some research has gone into the disruption of biofilm subgingivally due to the acoustic streaming effect of some sonic brushes. Although not conclusive it was felt that, 'The acoustic streaming effect of some sonic powered toothbrush can reach much further than the tip of the bristle. Although there will not be mechanical removal the disruption of the deeper film may aid the clinician and client in maintaining stability in a periodontal pocket or a false pocket'.

External factors

A patient’s general health, diet, smoking and drinking habits and stress should all be taken into account when trying to stabilise disease inducing dental biofilm.

Dental biofilm and caries

In dental caries, there is a shift toward community dominance by acidogenic and acid tolerating species such as mutants streptococci and lactobacilli, although other species with relevant traits may be involved. Strategies to control caries could include inhibition of biofilm development (for example, prevention of attachment of cariogenic bacteria, manipulation of cell signaling mechanisms, delivery of effective antimicrobials, etc), or enhancement of the host defenses. Additionally, these more conventional approaches could be augmented by interference with the factors that enable the cariogenic bacteria to escape from the normal homeostatic mechanisms that restrict their growth in plaque and out compete the organisms associated with health. Evidence suggests that regular conditions of low pH in plaque select for mutants streptococci and lactobacilli. Therefore, the suppression of sugar catabolism and acid production by the use of metabolic inhibitors and non-fermentable artificial sweeteners in snacks, or the stimulation of saliva flow, could assist in the maintenance of homeostasis in plaque.

Summary Box

Reducing the caries forming biofilm
- Decrease sugar intake in clients’ diet
- Improve oral hygiene
- Increase saliva flow

About the author

Mhari Coxon

is a dental hygienist practising in Central London. She is chairman of the London British Society of Dental Hygiene and Therapy (BS-DHT) regional group and is on the publications committee of its journal, Dental Health. She is also clinical director of CPDforDCP, which provides CPD courses for all DCPs. To contact Mhari, email mhari.coxon@cpdfordcp.co.uk.
Full Dentures
the dento-legal implications

Although new techniques and new materials are creating new opportunities, and new challenges for clinicians to meet and overcome—not to mention new dento-legal risks to deal with—there are still plenty of familiar ‘old chestnuts’ that crop up with monotonous frequency in claims and complaints against dentists. One such problem is the provision of replacement full dentures. This article deals specifically with their provision for patients who are already edentulous, in one or both arches as opposed to immediate edentulous, in one or both arches as opposed to immediate

Fig. 2

full (complete) dentures. This article deals specifically with their provision for patients who are already edentulous, in one or both arches as opposed to immediate replacement full dentures.

Daunting Dentures
Most clinicians will have experienced the humming and soul destroying experience of multiple retries (trial insertions) of full dentures or endless adjustments/cases of newly-provided dentures, or even the indignity of having to remake the dentures on one or more occasions, only for the patient to send back, declaring the new dentures to be unwearable. Most of the complaints and claims associated with full dentures can be categorised into three groups:
- the oral cavity
- the patient
- the clinician

An irregular maxillary alveolar ridge together with a tendency to a dry mouth and an existing stomatitis could be a challenge, particularly when opposed by the natural anterior teeth and a lower partial denture.

Fig. 3

Prospects of success when providing complete dentures is more likely to be happy with the dentures; conversely once a patient loses confidence in the clinician who is providing the dentures, the prospects of a successful outcome can be slender or non-existent.

The Oral Cavity
Although it may seem self-evident, an essential prerequisite of successful full denture construction is to be a properly detailed assessment of the patient’s mouth—the quality and suitability of the edentulous ridges and the soft tissue of the denture-bearing areas, the occlusion and vertical dimension, the musculature, and any complications introduced by the lips, tongue or cheeks, for example. Additionally, the quality and quantity of the patient’s saliva may have a direct impact on the retention and comfort of the denture.

Dry mouth or significant changes in the content/quality of saliva is commonly found in the elderly, and often compounded by certain medical conditions and by many different types of medication. A careful medical history and assessment of the saliva can alert a clinician to possible problems arising from this area.

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Recording the Assessment
Surprisingly few dental records for complete denture cases confirm that these essential first steps have been taken, so it becomes easy for patients (or their lawyers) to argue that the clinician has failed in his/her duty of care to carry out a full examination and assessment prior to constructing the dentures.

When things go wrong in the later stages of denture construction, it is easy to blame the event and not uncommonly a dentist will say ‘this was always going to be a difficult denture because of the patient’s bite’ (or the lack of edentulous ridges, or dry mouth etc). This then invites the question of whether these problems were ever discussed in sufficient detail with the patient before proceeding.

If you do anticipate problems for any reason, then take the time to warn the patient, and record these warnings in a dated entry in the clinical notes. Without such record/card entries, the way is left open for the patient to argue ‘I would never have gone ahead with these dentures if the dentist had only explained to me that...’

This is essentially a consent issue, although it may not have appeared so at first sight. That same line of thinking begs the question ‘had the patient been appropriately and adequately warned, would he or she preferred a referral to a prosthodontic specialist, or perhaps to someone with special expertise or experience in full denture construction?’ In short, if the initial examination reveals anything about the patient’s mouth that would limit the prospects of constructing full dentures successfully, then discuss these constraints with the patient in advance.

The Patient
As we all know, different patients present with different problems. Some are extremely demanding and difficult to satisfy, others seem impossible to deflect from unrealistic expectations of treatment outcomes. Some talk too much and are apparently determined to control the treatment at every stage, while others talk too little and fail to give us crucially important information about their previous history or current problems. With some patients we are on a hiding to nothing from the outset—because of our age, or sex, or appearance, or ethnicity, and because they come to us with preconceptions and perceptions of what they want, what they expected, and what they need.

Clinical Confidence
All of these problems—and more—can prejudice the prospects of success when providing complete dentures. A patient, who is confident in the clinician providing the dentures, is more likely to be happy with the dentures; conversely once a patient loses confidence in the clinician who is providing the dentures, the prospects of a successful outcome can be slender or non-existent.

Getting to Know Them
It is short-sighted to focus exclusively on the dentures themselves; an important aspect of the equation in full denture construction is to maintain the relationship between

An irregular maxillary alveolar ridge together with a tendency to a dry mouth and an existing stomatitis could be a challenge, particularly when opposed by the natural anterior teeth and a lower partial denture.

Fig. 4

Plenty of alveolar bone for retention of the upper denture, but the mandible could be more of a problem. It would be sensible to keep tight control of the patient’s level of expectation in this potentially difficult case.

Fig. 6

Clinical 19

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Fig. 5

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Fig. 7

Clinical 19
dentist and patient. Time spent at
the outset in getting to know the pa-
tient and understanding any expec-
tations, is seldom wasted. If nothing
else, it can alert you to situations
where the best option is not to be-
come involved in the treatment at
all, or where the additional experi-
ence of a specialist is advisable.

The emotional component as-
sociated with full dentures is not of-
ten appreciated. It is worth consid-
ering why the patient has chosen
this particular moment to seek the
replacement of the dentures they
have been wearing for so many
years. An understanding of the pa-
tient’s motivation often provides
the key to understanding his/her
needs and expectations. It may also
alert the clinician to the potential
difficulties.

Getting Used to Them

A patient’s ability to adjust to
new dentures that are different in
some ways from others worn over
a long period, may be influenced
by events in his/her life that are
quite unrelated to the dentures
themselves. The dentures become
a convenient scapegoat for an un-
happy patient to focus his/her
problems on. Adapting to the new
dentures may simply represent
one challenge too many for a pa-
tient who is already under stress
for one reason or another, and
whose ‘coping’ mechanisms are
already compromised for reasons
outside the clinician’s control.

The Clinician

There is still a lot of wisdom in
the old adage that an extra five
minutes spent at each stage of the
construction of a denture, saves
ten minutes at the next. Anyone
who has accepted a less-than-op-
timal impression, or who has
pushed the ‘bite’ stage of a full den-
ture, will probably relive a few
nightmare cases upon reading
this. Similarly, adjustments that
are easily and inexpensively made
at the wax ‘try-in’ stage, are a
costly and time consuming frus-
tration once the dentures have
been completed.

Easy Does It

‘Eases’ and other adjustments
of a temporary nature are not an
dentist’s business. They are quick
and easy enough to achieve, but each
successive removal of acrylic
flour to be considered very care-
fully. Before removing any acrylic
from a completed denture, it is
worth reminding yourself what it is
designed to achieve, and for
whose benefit the material is be-
ing removed. After several cases,
this is a danger you will have re-
moved much of the retention ini-
tially achieved by denture flanges,
or the accuracy of the fitting sur-
face. Adjustments in the ‘post-
dam’ area should be approached
with caution. Many such adjust-
ments made at the patient’s insis-
tence have eventually led to the
need for a complete remake.

When to Stop

If patients return time and time
again, complaining that they are
unable to wear their dentures, it is
tempting to dismiss them as pa-
tients who will never be satisfied,
whatever is done for them. It is salu-
tary to remember that the majority
of these patients subsequently go on
to have perfectly satisfactory
dentures constructed by another
dentist.

Dentists who have remade
dentures on one or more occa-
sions, or who have invested a
great deal of time over many vis-
its, may feel that they have done
everything humanly possible to
achieve a satisfactory outcome
for the patient. This makes it all
the more frustrating and hurtful
when patients throw all this com-
mitment back at the dentist, say-
ing that they had attended twenty
times, and allowed the dentist to
have three attempts, but the den-
tist was still unable to make a
denture that they could wear.

A New Start

One learns with experience
when that stage has been
reached. This is the time when it
makes more sense for the patient
to make a fresh start with another
dentist, than to persevere with a
case when the confidence and
patience is wearing very thin on
both sides.

About the author

We are the world’s largest spe-
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Minimal intervention, best results

James Goolnik insists you needn’t drill your patients teeth away to create the perfect smile, when you can use Durathin porcelain veneers

Think about it. You carry out smile-design principles and remove healthy enamel for the labial surface of your patients’ teeth. No matter how good your clinical skills, your patient is likely to have transient sensitivity during the temporisation phase and for a brief period after final cementation of your new restorations. Even in the most conservative preparations 10 per cent of the teeth you have prepared will lose vitality in the future. You are also relying on fifth-generation bonding agents, so there is a possibility of debonding in the future.

An aesthetic alternative

You may have heard of minimal-preparation veneers, but not seen any cases that look good. This is a thing of the past, now that Durathin porcelain veneers are available in Europe. Invented by Mark Willies and Dennis Wells, they are natural looking, ultra-thin (0.2mm) veneers that once bonded to the enamel of the teeth give both you and the patient what they are looking for. This is a paradigm shift in the thinking of all the team. The most critical step is in the planning stage. It is essential you provide the patient with provisional restorations in which they can ‘test drive’ their new smile. This is carried out in two ways:

1. Diagnostic wax-up. Using a technician who also thinks in the same field. An additive technique allowing a realistic smile. Then using silted matrix to copy this into a provisional smile (Luxatemp) in the mouth.
2. Direct composite mock-up (my preference). Adding composite and sculpting it to get a beautiful smile. Take an alginate to send to the laboratory to copy.

Ask the patient to return a few days later to check the appearance and speech. Flick the restorations off and take accurate silicone impressions and send to the laboratory. There’s no need for further temporisation unless the patient cannot wait to show off their new smile.

On the fit appointment, no anaesthetic is necessary, you may choose to use a small amount of anaesthetic to make the rubber dam placement more comfortable. The seating protocol is slightly different as the restorations are more delicate until cemented so a delicate touch is advised. No drills, no sensitivity, no anaesthetic and they can be removed with almost no changes to the enamel.

If you want to find out more, Dr Dennis Wells, Dr James Goolnik and Mark Wallis will be presenting Minimal Intervention Dentistry, otherwise known as ‘you are not going to drill my tooth down to a stump!’ on Friday June 26. They will also be offering a hands-on verification course.

The beauty of precision
Made by DMG.

Luxatemp

Provisionals should not only look good they should, above all, fit well, immediately and precisely. Luxatemp from DMG offers the perfect fit you can rely on. It is therefore no surprise that the material is a worldwide success – and has been the Number 1 in the US for a decade. And, furthermore, the natural fluorescence gives it a great appearance. Nice when everything fits. DMG. A smile ahead.

Additional information is available at www.dmg-dental.com

* The Dental Advisor 2006, Vol 23, No. 6, s. 8/9
Tips for carrying out occlusal treatment

David Bloom and Jay Padayachy of Senova Dental Studios offer their top 10 tips on assessing your patient for occlusal problems

1/ In an ideal occlusal scheme, Centric Relation (CR) is coincident with Centric Occlusion (CO). See fig 1. This occurs naturally in only 10 per cent of the population.

2/ Assess any discrepancy between CR and CO, as this may result in a slide with the potential for occlusal disharmony.

3/ Assess the static occlusion to evaluate the overbite and overjet. The overbite will help determine how much incisal length can be increased with or without opening the vertical dimension and will help the diagnosis of a traumatic palatal occlusion or anterior open bite. The overjet will help determine the teeth that will be involved in the excursive scheme. It is essential that the teeth as far away from the hinge axis that the skeletal pattern will allow take the excursive loads.

4/ Assess for wear facets and abfraction lesions. Use Shimstock and articulating paper to assess holding contacts before doing any restorations. See figures 2 and 3 – these show poor guidance in right hand excursion.

5/ Assess anterior and protrusive guidance – ideally there is a canine protected occlusal scheme with posterior disclusion in all lateral and protrusive excursions. Failing this, anterior group function is acceptable but there must be NO working and/or non-working interferences and no posterior interferences in protrusion. See figs 4 to 6.

6/ Do I work in CO or CR? CO or conformative dentistry is most commonly used in single tooth or quadrant dentistry while CR or reorganised occlusion is most commonly used in rehabilitation cases. Reorganising an occlusion can be as non invasive as an equilibration or can involve a full arch or even a full mouth reconstruction.

7/ Assess bitewing radiographs for the presence of any vertical bony defects, which may be associated with poor function – see fig 7.

8/ Believe your patient – if they say that the bite ‘feels high’ after placing a restoration (direct or indirect) it probably is!

9/ Triple trays work well for single tooth or quadrant dentistry but check patient is in CO.

10/ Learn how to use a face bow as articulators are essential for larger cases or smile cases.

And remember to attend an occlusion course to help your understanding of the basic principles and the diagnosis of occlusal disease and their potential consequences.
CO-OP.R8 Seminars Proudly Presents:
William “Bo” Bruce, DMD
David R. Newkirk, DDS

“What MUST I have to treatment plan aesthetic cases?”

This hands-on course is designed to answer that question. Knowing how to prep and cement veneers is not enough to go forward with a comprehensive case. We must know what information and materials we need to put the puzzle together.

This course will give you the blueprints to any complex case in a simple and understandable way. You will learn not only the aesthetic requirements but also the functional necessities to the perfect case. Not required, but would be a real bonus if your dental assistant could attend with you.

This is a must take course for any dentist wanting to do more complex aesthetic and/or functional cases.

Course Synopsis
- Why and how to take a face bow
- How to predict and easily verify a proper joint position
- How to diagnose a healthy joint from a problem joint
- How to verify mountings of all model work
- Pearls that will make every case 100% more predictable

14 hours of CPD

This two day Hands on masterclass will be held at the prestigious Senova Dental Studios, Watford, Hertfordshire on Saturday 25th and Sunday 26th April 2009.

Book early to avoid disappointment for just £995 plus VAT.

To secure your place please contact info@coopr8.com tel: 01923 655404

Dr David Bloom, a graduate of the Newcastle-upon-Tyne Dental School, has been a principle at Senova Dental Studios since 1990 focusing on comprehensive restorative and cosmetic dentistry. A past president of the British Academy of Cosmetic Dentistry (2007-2008), David is also an accredited member of the BACD, one of only 10 in the world. He is a member of The British Society of Occlusal Studies, The British Society of Restorative Dentistry, The British Dental Association and is a sustaining member of The American Academy of Cosmetic Dentistry (AAACD). He is also a fellow of the International Academy of Dental Facial Aesthetics. David is on the editorial board of the Journal of Cosmetic Dentistry – the official journal of the American Academy of Cosmetic Dentistry and is a clinical director of CO-OP.R8 seminars, instructing and lecturing on all aspects of cosmetic dentistry in the UK and the US. (www.coopr8.com).

Dr Jay Padayachay, a graduate of the Newcastle-upon-Tyne Dental school, has been a principle at Senova Dental Studios since 1998 focusing on comprehensive restorative and cosmetic dentistry. A full member of the British Academy of Cosmetic Dentistry, he is a member of The British Society for Occlusal Studies, The British Society of Restorative Dentistry, The Pankey Association, The British Society of Periodontology and the American Academy of Cosmetic Dentistry of which he is a sustaining member. He is also a director of CO-OP.R8 seminars and lectures in all aspects of cosmetic dentistry in the UK. (www.coopr8.com).