VOLUME 1

HOW CAN BIOFILM AFFECT MY DIAGNOSIS AND TREATMENTS?

An eBook by

AdDent INCORPORATED

Advancing Dental Excellence

INTRODUCTION:

Biofilm is an ever-present risk that impacts the entire spectrum of oral health, with its most common manifestation being dental plaque. Indeed, one of the largest toothpaste manufacturers refers to it extensively in their current campaigns. However, biofilm is omnipresent across most other significant areas of reactive dental treatment, increasing infection risks in peri-implantitis, periodontitis, and endodontic disease in the oral cavity. Once you get into the wider dental practice environment, it can be found on instruments, worktops, devices, equipment, and furniture. As well as inside waterlines. So, it is pretty much central to every facet of dental treatment.

As with all risk mitigation, understanding what biofilm is and how it forms is a vital first step in taking control of the situation. Armed with this knowledge, dental professionals can provide satisfactory solutions - through education to change in-practice behaviors and with the intervention of professional treatment and products.[1]

CHAPTER 1:

HOW DOES BIOFILM FORM?

Clusters of microorganisms can form biofilm colonies rapidly and unexpectedly, as the famous Martini tagline from the 1980s reminds us: Biofilm can form "*anytime, anyplace, anywhere*!" According to scientific evidence in microbiology, biofilm formation is highly unpredictable.

You can optimize treatment outcomes by understanding the five stages of biofilm formation and taking *proactive* steps to mitigate it. (Fig.1).

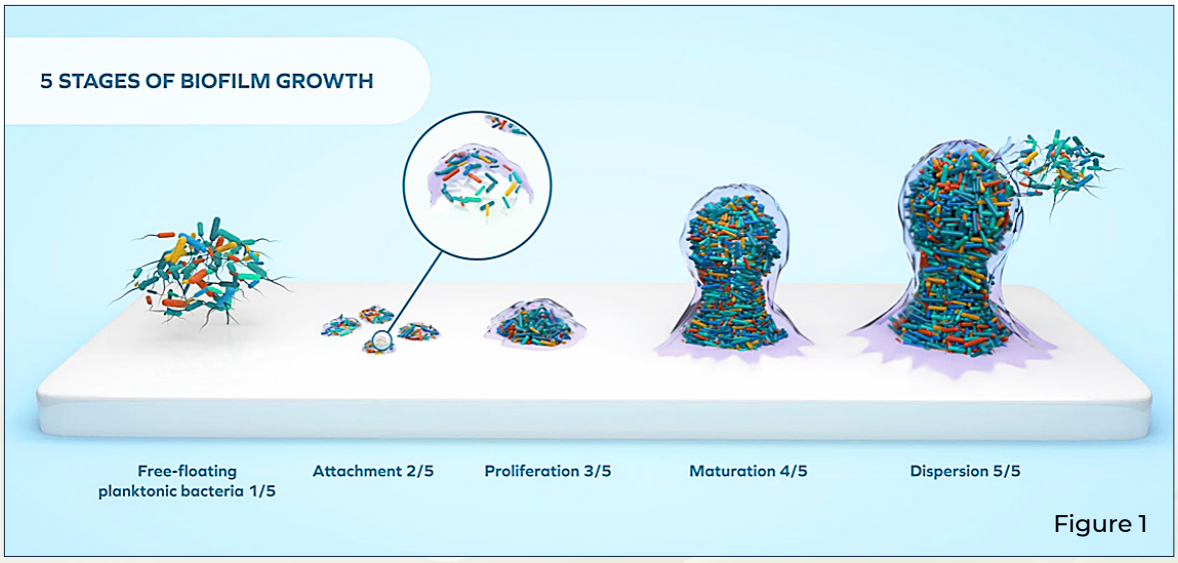
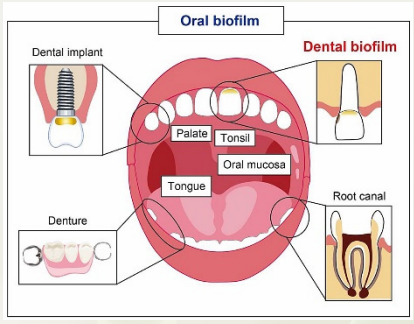
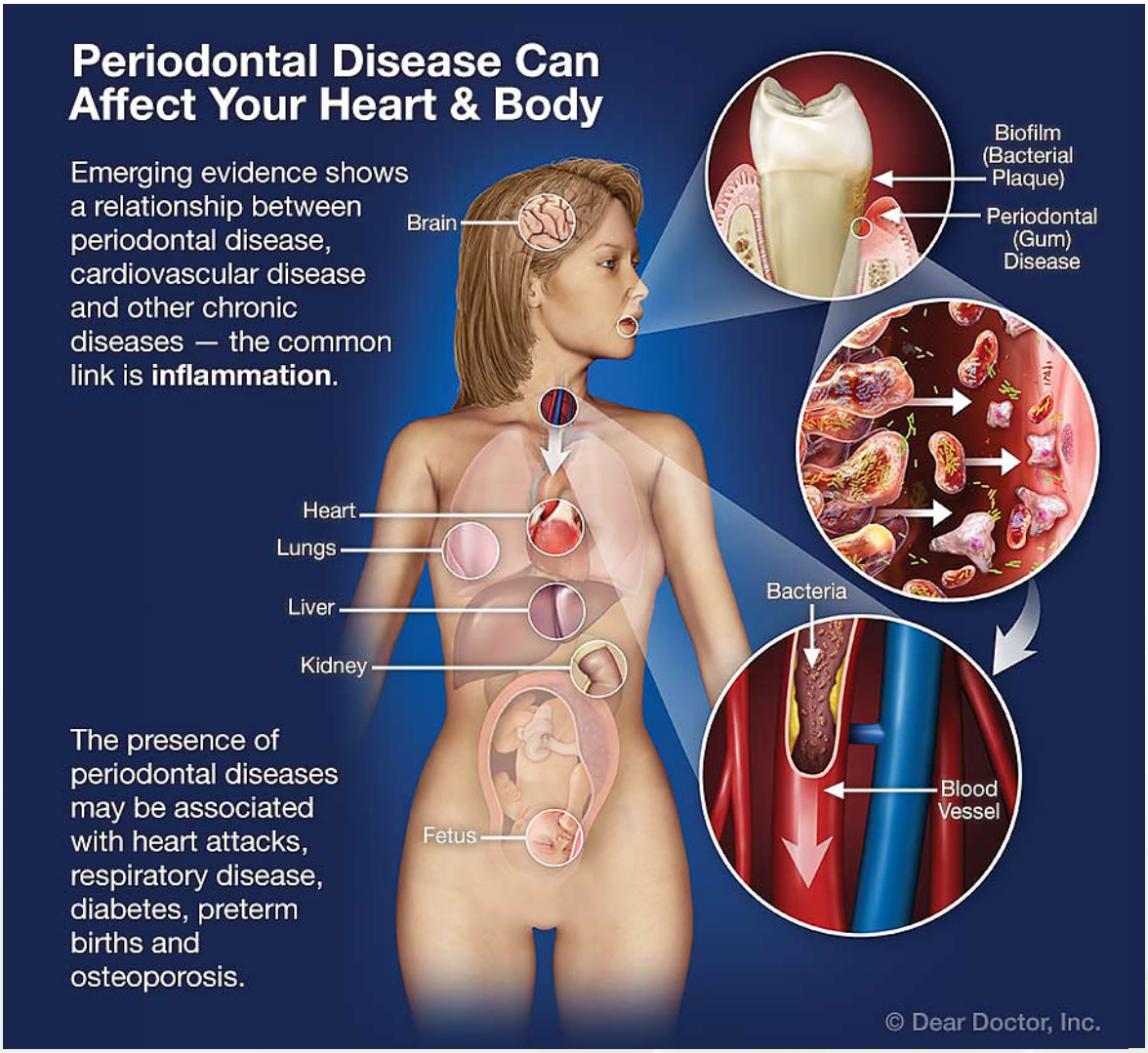


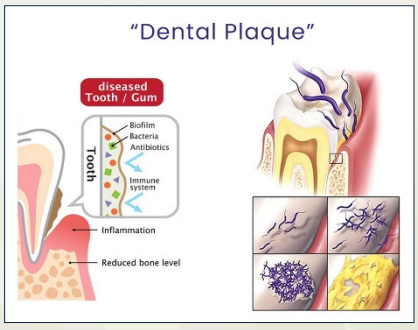
Figure 1



Most infection control products focus on eliminating free-floating planktonic bacteria in Stage 1, using compounds such as alcohols, quaternary ammonium compounds (QACs), chlorine-based strong acids like hypochlorite, and weaker acids like hypochlorous.

More complex issues arise when bacteria attach themselves to surfaces such as teeth, gums, implants, and wet surfaces, or gather in pockets in the roots of teeth. This leads to the rapid formation of biofilm, which is still not fully understood by scientists. However, it is certain that if left unchecked, biofilm can be detrimental, and even life-threatening, to dental patients.[1]





In recent years, research has shown that periodontitis is linked to several systemic diseases and conditions. These include cardiovascular disease, diabetes mellitus, respiratory disease, adverse pregnancy outcomes, obesity, pancreatic cancer, and Alzheimer's disease.[2]

Biofilms are communities of bacteria that exist in both the human body and the environment. If left unattended, these biofilms undergo maturation, and the resulting pathogenic bacterial complex can lead to dental caries, gingivitis, and periodontitis.[3] It is important to identify, disrupt, and manage these biofilms to ensure the success of your treatments and the well-being of your patients.

CHAPTER 2:

WHERE BIOFILM FORMS AND WHAT ARE ITS EFFECTS.

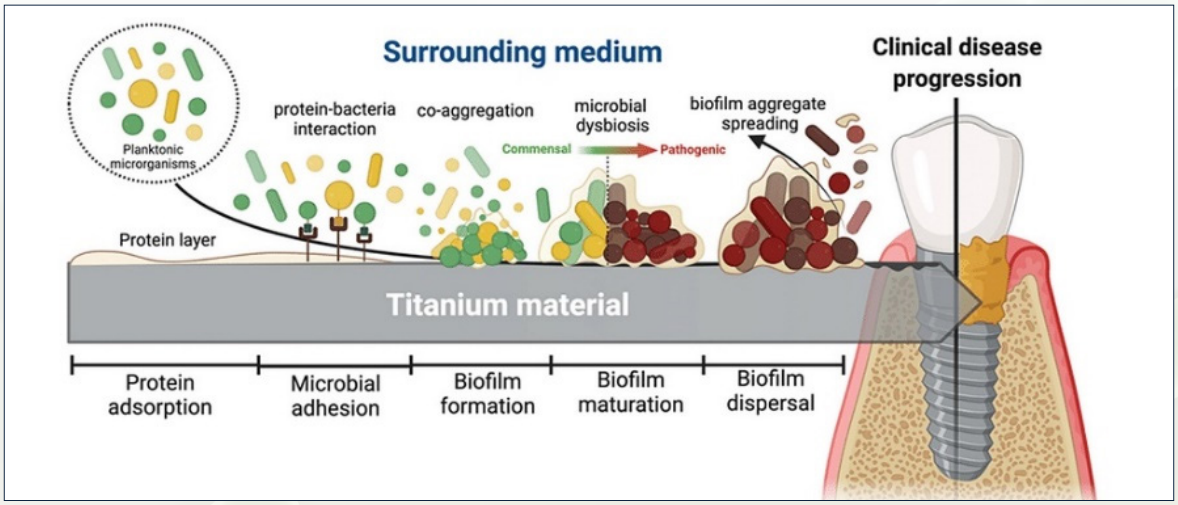
Dental Restorations (Crowns, Bridges, and Fillings): Biofilm tends to accumulate on dental restorations due to their surfaces, texture, anatomical form, and chemical composition. Gaps and grooves between teeth and restorations can also attract biofilm, making it difficult to remove mechanically. These hard-to-reach areas can allow biofilm to thrive and grow. Biofilm is most likely to be present at the margins and on the surfaces of existing restorations. These biofilms are not visible to the eye or X-ray, they generally reveal themselves only afterward when their handy work is well on its way.

Secondary caries at the crown margin (black arrow) caused by the accumulation of biofilm in the crevice between crown and tooth. Hyperplastic gingiva (white arrows) due to increased plaque accumulation in the connector area of the fixed partial denture. The connector of the bridge has a bulky design which complicates interdental hygiene (*photo by Marit Oilo*)

Crowns and bridges are commonly made from ceramics, metals, or a combination of the two. Ceramic materials have a smooth, polished surface that makes them easy to clean and remove biofilm. However, some crown, bridge, and inlay/onlay margins may have uneven or rough edges due to adjustments made during creation. A margin with many small defects will retain more plaque and bacteria than a smooth margin. While most metals can be polished to reduce biofilm retention, certain alloys are more susceptible to bacterial growth due to electrical charges. It is challenging to create restorations with perfect adaptations, so the interface between the tooth and the restoration is often problematic. Cement can fill any gaps, but it can also attract biofilm.

Polymers, such as BisGMA and UDMA resin-based composites, glass ionomers, and acrylics, have more pores and defects in their surfaces than metals, ceramics, and enamel. Porosities make perfect incubation chambers for biofilm and certain microbes. Biofilms on polymers develop and attach quicker and will be more difficult to remove completely. Acidic residues from the bacteria over time will roughen the surface, which will further complicate biofilm removal.[4]

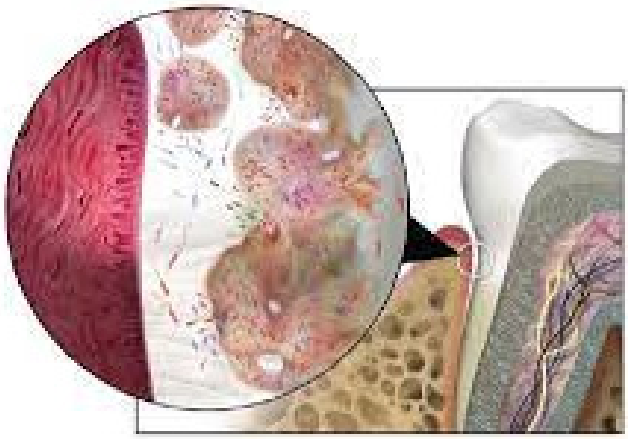
Implants: Dental implants are structures made of titanium, zirconium, and synthetic plastic materials that replace missing teeth. However, people with implants can develop infections and inflammation in the implant region, which is called peri-implantitis. This occurs when bacteria around the implant site aggregate and form a biofilm. The roughness of the implant's surface can affect bacterial adhesion to the implant, which may contribute to biofilm growth. Peri-implantitis is a destructive inflammatory process that affects the soft and bony tissues supporting the implant.[5]



Fluorescence can be used clinically during the routine care of patients with dental implants. It allows easy and immediate visualization of:

- Mature oral biofilm for its adequate removal
- Evaluation of the quality of restoration to the sealing of screw access-hole
- Identification of caries in partially edentulous patients with no risk of allergic reactions or staining of prostheses and restorations.6

Periodontal: Detection of dental biofilm may be the first step for diagnosis of dental caries i.e. (Class V gingival margins) and subsequent diseases like periodontitis.[2]



Bioflim lodges in the crevices around the teeth both above and below the gingival margins. Accumulation of dental plaque biofilm can result in dental caries and periodontal disease.

Periodontitis is an inflammatory disease affecting tooth-supporting structures. It is caused by bacteria that form biofilms at the gingival margin. The bacterial composition of biofilms associated with periodontitis has been well-documented and is continually under investigation.[4]

Dentures: Many people who wear dentures often have biofilms in their mouths that contain Candida albicans, a harmful fungus that grows on the denture material known as polymethyl acrylate (PMA). Due to the high presence of Candida in the mouth, denture wearers are at risk of developing denture stomatitis, which is an inflammation of the oral tissues. Shockingly, more than 65% of denture wearers suffer from this condition, which can lead to poor oral health, dental hygiene, and even systemic diseases such as diabetes.[7]

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