

## REVIEW ARTICLE

# A Review on Dental Bio-Films: Recent Modern Functional Studies

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### ABSTRACT

Nowadays, there are many efforts to improve high effective techniques to remove dental biofilms which some recently approaches are highlighted in this review, as elimination of the dental biofilm will notably prohibit the expansion of caries and gum diseases. In order to the fact that the better dental hygiene the long-term health of dental and gingival conditions it appears so critical to detect and remove dental biofilm with better and more efficient methods as soon as possible. Including these attempts, efforts to produce Modified implant surface, better interdental brushes, enhance Effectiveness of tooth wipes, suggest new creative chemical methods and physical techniques and manufacture newer instrument detecting and reducing biofilm are outstanding. Regarding this fact, this review article performed to gather recently different variety novel techniques and materials having remarkable dental plaque removal property based on published Information from Pub Med, and some dental databases. As a result of this study, although some newer technologies significantly have been developed to identify and selectively remove the dental calculus, none of these conventional methods or devices seemed effective in completely eliminating all the calculus from the diseased root surfaces. Finally to have more effective methods further investigations are required.

**Keywords;** Biofilms, Technology, Implant

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## INTRODUCTION

Supragingival and Sub gingival biofilm are two types of dental plaque forming above and under gums contained anaerobic and aerobic bacteria that could entail dental caries and periodontal disease if they do not be removed in appropriate time. [1] Moreover, it is undeniable that microbial biofilm removal play important role to prevent dental caries and gum diseases. [2]

Also, As innovative dental biofilm remove methods may play significant role in prevention of dental and gum diseases and the most of conventional modalities represent sort of limitation in eliminating dental plaque entirely calculus from the diseased root surfaces, Many studies carried out to use newer materials and Technologies based on better efficacy. [3]

In some articles removing of dental biofilm have been occasionally defined in to the Surgical and non-surgical using methods, although in new past decades many newer techniques experimented and investigated which may not being mentioned in to these categories. In this review research, some newest techniques to remove dental biofilm are accumulated from Google Scholar, Pub Med, and some dental databases.

## IMPROVEMENT OF TOOTHBRUSHES, INTERDENTALLY BRUSHES, AIR POLISHING METHODS, DENTURE/ DENTAL CLEANERS, AND INNOVATIVE CLEANING TECHNIQUES

Fabrication of newer toothbrush with better mechanical cleaning ability is a branch of this aim, as an example, a new tooth brush designed by Luciana Assirati CASEMIRO have decreased tongue bacteria

which enhance tooth environmental hygiene [4]. A study published in 2015 for the first time it has been illustrated that the single use of the sonic toothbrush revealed more efficient property to remove dental plaque than manual traditional toothbrush [5]. In 2014 Schmidt JC et al. have evaluated the efficacy of four different kinds of side-to-side toothbrushes on specific three-species biofilm on titanium surface in vitro which have showed decreasing of biofilm [6]. Relatively, another research declared the better efficacy of biofilm abrasion of medium toothbrushes than soft toothbrushes [7]. Also, new investigations to avoid toothbrush infection have been taking place, such as, Spolidorio DM work to evaluate two different prevention methods [8]. As a good achievement, Sonic are toothbrush revealed better effect on disturbing biofilm and also oral health than another leading power toothbrush [9]. However, in contrast to angled interdental brushes, Straight interdental brushes eliminate more inter-proximally biofilm [10]. Moreover, it is verified that glycine powder air polishing is a better biofilm remover in moderate-to-deep periodontal pockets than scaling and root planning followed by coronal polishing. [11] It is not so long that applying an ionized gas named Cold Atmospheric Plasma are considered in many researches by the aim of dentistry therapeutic purpose which may have important properties to remove dental biofilm, tooth whitening and composite amendment [12]. Cold-adapted proteases, such as Acidic endopeptidases (trypsin and chymotrypsin-like enzymes) and exopeptidases (carboxypeptidase A and B) driven from Arctic krill applying in wide range of demands have illustrated a promising therapeutic perspective to prohibit periodontal disease by eliminating bacterial biofilm [13].

**SURGICAL DENTAL BIOFILM REMOVE METHODS CLASSIFICATION AND RECENTLY TECHNIQUES DEVELOPMENT**

According to a review article published by Pilar Valderrama and Thomas G. Wilson Jr in 2013, as showed in table 1, variety different commonly applied surgical methods in different experiments of detoxification of dental Implant body Surfaces from 1966 to 2013 have been described, as a result, Applying these surgical methods are not entirely efficient in removing whole surface biofilm beyond inducing all physical and chemical changes, thus the newer effective methods seems to be required [14] (Table 1).

Table 1. Common surgical techniques used to remove dental implant biofilm [14]

Mechanical Methods	<ol style="list-style-type: none"> <li>1. Implantoplasty <ul style="list-style-type: none"> <li>➤ Applying rotary instruments to remove biofilms</li> <li>➤ Decrease the roughness of the titanium surface</li> </ul> </li> <li>2. Air Powder Abrasive <ul style="list-style-type: none"> <li>➤ This medium use a mix of air, water, and powder at pressures of 65 to 100 pounds per square inch (psi)</li> <li>➤ scrubbing the previously contaminated implant surfaces [15]</li> </ul> </li> <li>3. Ultrasonic Scaler with a Metal Tip <ul style="list-style-type: none"> <li>➤ effective than plastic tip ultrasonic scalers [16]</li> </ul> </li> </ol>
Chemical Methods	<ol style="list-style-type: none"> <li>1. Citric Acid (CA) <ul style="list-style-type: none"> <li>➤ Widely applied to cleaning of the implant surface based on published literatures</li> </ul> </li> <li>2. Chlorhexidine (CHX) <ul style="list-style-type: none"> <li>➤ as a local antimicrobial</li> </ul> </li> <li>3. Ethylene Diamine Tetraacetic Acid (EDTA) <ul style="list-style-type: none"> <li>➤ Having chelating properties</li> </ul> </li> <li>4. Hydrogen Peroxide: (HP) <ul style="list-style-type: none"> <li>➤ the least efficacy in contrast to citric acid, plastic sonic scaler tip sand air powder abrasive [17]</li> </ul> </li> <li>5. Saline and Saline Soaked Cotton Pellet</li> <li>6. Tetracycline (T) <ul style="list-style-type: none"> <li>➤ Abacteriostatic antibiotic</li> </ul> </li> </ol>
Lasers	<ol style="list-style-type: none"> <li>1. Erbium-Doped: Yttrium, Aluminum Garnet (Er:YAG) Laser</li> <li>2. Continuous CO<sub>2</sub> Laser</li> <li>3. Photodynamic Therapy (PDT).</li> </ol>

**NON- SURGICAL DENTAL BIOFILM REMOVE METHODS CLASSIFICATION AND RECENTLY TECHNIQUES DEVELOPMENT**

In another complementary effort, Pilar Valderrama, et al. in 2014 gathered effective non- surgical detoxification methods of dental Implant body Surfaces from 1966 to 2013 based on published researches. The common non- surgical methods categorized in table 2, the result of his review declared the limitation of these techniques in completely biofilm elimination of dental implants affected by peri- implantitis and peri-implant mucositis biofilm and indicate the better effect of applying combination non-surgical protocols [18] (Table2).

In a comparison manner, the results of a research carried out in 2015 to evaluate the elimination of biofilm and surface reformation properties of some non –surgical periodontal therapy techniques on Periodontal Ligament Fibroblasts, indicate the preferable characteristics of using the Air-polishing with erythritol method showed the surface with nearly no residual biofilm [19].

Moreover, there is variety different literatures presenting new information of dental biofilm removing modalities, for instance, in a study published by Peters OA et al. the effectiveness of using laser activation method to remove bacteria from dental root canal approved, while it declared to apply ultrasonic activation the further complementary experiments required [20].

Table2. Conventional non-surgical techniques used to remove dental implant biofilm [18]

Mechanical Methods	<ol style="list-style-type: none"> <li>1. Implantoplasty</li> <li>➤ Applying rotary instruments to remove biofilms</li> <li>➤ Decrease the roughness of the implant surface to reduce biofilms colonization [21]</li> <li>2. Air Powder Abrasives (AP)</li> <li>➤ an abrasive powder pushed by a stream of compressed air and water to remove biofilms [22]</li> <li>3. Metallic Curettes</li> <li>4. Non- Metallic Curettes</li> <li>➤ Curettes can be Constructed of carbon, plastic, resin-reinforced and resin-un-reinforced</li> <li>5. Rubber Cups</li> </ol>
Chemical Methods	<ol style="list-style-type: none"> <li>1. Citric Acid (CA)</li> <li>2. Chlorhexidine (CHX)</li> <li>3. Hydrogen Peroxide: (HP)</li> </ol>
Lasers	In variety different types
Photodynamic Therapy (PDT)	<ul style="list-style-type: none"> <li>➤ coating implant surface with a specific photosensitizing agent and following activation by once light simulation in the certain wavelength and the presence of oxygen</li> <li>➤ Better results of combination use of photosensitizing with laser to decrease bacterial counts from influenced implants</li> </ul>

### REMOVING OF DENTURE BIOFILM AND NEW DEVELOPING METHODS

Appropriate denture hygiene is one of the critical factors to prevent gum bacterial infection and disease for those with denture, though through few last decades many investigations carried out to assess the biofilm removing ability of variety different dental and/or denture cleaners and modern developed technologies. In a research have been performed by Patrícia Costa CRUZ, et al. in 2011, the applying results of alkaline peroxide and ultrasonic methods on complete denture have declared the proper efficacy of three chemical, mechanical and combined methods [23]. Titanium dioxide coating of denture base acrylic resin experimented in 2009, revealed a promising method to prevent denture biofilm formation [24].

The more exposure of dentures in denture cleansers may reduce surface roughness of denture base resins and metals and the smoother denture surface cause less biofilm formation. Thus, many studies try to compromise variety different denture biofilm removal methods to find the more effective and efficient types of denture cleaner and newer cleaning technologies. For instance, the result of study evaluated the Effect of Denture Cleansers on surface of Denture Base Material have showed that Cepacol, As a denture cleaner, significantly increase the roughness of the denture acrylic resin, Although, Further researches with biofilm are required to determine other impact of these cleaners [25].

The impact of brushing dental dentures fabricated of heat polymerized poly methyl methacrylate (PMMA) with a low-cost powered toothbrush have demonstrated the *Candida albicans* biofilm elimination

performed by Tan CM, et al. In 2014, however, it revealed limited changes in flexural strength after brushing [26]. Also, based on a research evaluating the impact of some cleaning methods on the *C albicans* biofilm made on soft denture liners, NaOCl cleaner showed the highest biofilm removing performance [27].

The impact of chlorhexidine solutions on denture biofilm have been considered in a research estimated that they can be used as an efficient auxiliary cleaning method in edentulous patients [28].

## CONCLUSION

As a result, it seems that the most of these methods published in variety literatures suggesting new effective methods need more investigation and improvement in different other aspects, although some of them have shown high efficacy in decreasing dental and denture biofilm.

None of these conventional methods or devices was effective in completely eliminating all the calculus from the diseased root surfaces. In this context, a number of newer technologies have been developed to identify and selectively remove the dental calculus

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