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GUIDED BIOFILM THERAPY (GBT)

Dr. Shyam Sharma K.*[1], Dr. Jaishree Tukaram Kshirsagar[2], Dr. Sathyasree M.[3], Dr. Richardson I.[4], Dr. Meghana T.[5], Dr. Vinu Priya P.[6] and Dr. Mohamed Riyaz J.[7]

[1,3,4,5,6,7]Postgraduate, Department of Periodontology, Tamil Nadu Government Dental College and Hospital, Chennai, Tamil Nadu, India.

[2]Professor and HOD, Department of Periodontology, Tamil Nadu Government Dental College and Hospital, Chennai, Tamil Nadu, India.

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***Corresponding Author**
Dr. Shyam Sharma K.
Postgraduate, Department of Periodontology, Tamil Nadu Government Dental College and Hospital, Chennai, Tamil Nadu, India.

INTRODUCTION

Overview of Periodontal Diseases

Periodontal diseases, which include conditions like gingivitis, periodontitis, and peri-implantitis, have become a significant public health issue across the globe. These diseases, which impact the structures supporting the teeth, are primarily caused by microbial biofilms, often referred to as dental plaque. Gingivitis, the mildest form of periodontal disease, is marked by inflammation and bleeding of the gums. Left untreated, it can progress into periodontitis, a more severe condition that involves loss of connective tissue and bone around the teeth, potentially leading to tooth loss. Peri-implantitis, similarly, affects dental implants, where biofilm accumulation leads to inflammation, bone loss, and failure of the implant. Studies show that nearly half of adults worldwide are affected by some form of periodontal disease, with a significant increase in severity as the population ages (Rajesh et al., 2023). The primary causative agent of periodontal diseases is dental biofilm, which is a structured community of bacteria that adheres to the tooth surfaces, forming a matrix that protects the bacteria from both host defenses and antimicrobial treatments. Over time, the biofilm becomes increasingly pathogenic, producing toxins that lead to tissue inflammation and bone resorption (Yin et al., 2023). This matrix, composed not only of bacterial colonies but also extracellular matrix, makes the biofilm particularly resilient and difficult to treat with conventional methods (Mishra et al., 2023).

Introduction to Guided Biofilm Therapy (GBT)

In response to the limitations of traditional SRP, **Guided Biofilm Therapy (GBT)** has been developed as a more precise, less invasive treatment approach. Introduced by Jan H. Koch in 2016, GBT represents a shift towards a more systematic and evidence-based approach to biofilm removal. This therapy combines various modern techniques, including disclosing agents, air-polishing devices, and ultrasonic scalers, to achieve more effective biofilm disruption and removal. GBT is a non-surgical treatment that not only removes biofilm but also minimizes discomfort, making it an attractive option for patients seeking a less invasive alternative to SRP (Rajesh et al., 2023).

At the heart of GBT is the concept of **biofilm visualization**. The use of disclosing agents, such as **erythrosine** or **gentian violet**, allows clinicians to precisely identify areas affected by biofilm, ensuring targeted treatment (Shrivastava et al., 2021). This method contrasts sharply with traditional techniques, which rely on tactile sensation and visual inspection, often leading to incomplete biofilm removal. After biofilm detection, GBT employs **air-polishing devices** that use low-abrasive powders, such as **erythritol**, to gently remove the biofilm without damaging soft tissues or tooth surfaces. This process is followed by the use of specialized ultrasonic scaling tips for the removal of deeper deposits and residual biofilm. These combined methods significantly enhance the efficiency of treatment and reduce the risk of adverse effects associated with conventional therapies (Rajesh et al., 2023; Yin et al., 2023).

The Concept of Guided Biofilm Therapy

Origin and Development

The management of biofilms in periodontics has undergone significant evolution over the years. Historically, dental plaque was viewed merely as a substance that needed to be removed mechanically, often through the use of manual instruments like curettes or sonic scalers. However, as the understanding of biofilms deepened, particularly with the advent of microbiological studies in the late 20th century, it became evident that biofilms are far more than just a layer of bacteria. They are dynamic, self-organizing communities of microorganisms embedded in a protective matrix, making them particularly resistant to traditional treatment methods (Sikder et al., 2021).

In 2016, the concept of **Guided Biofilm Therapy (GBT)** was introduced by Dr. Jan H. Koch and EMS (Electro Medical Systems), marking a pivotal moment in periodontal care. This

novel approach sought to address the challenge of biofilm removal in a more systematic and targeted manner. Unlike traditional treatments like scaling and root planing (SRP), which rely heavily on the tactile sense of the clinician, GBT employs a more structured method using **disclosing agents**, **air-polishing devices**, and **ultrasonic scaling** to achieve better biofilm disruption and removal (Rajesh et al., 2023). These tools work together to visualize, clean, and debride dental surfaces, ensuring that biofilm is removed effectively without damaging healthy tissues.

Mechanism of Action

The mechanism of action behind GBT is based on the concept of **selective biofilm removal**. The process begins with the application of **disclosing agents**. These agents, such as **gentian violet** and **erythrosine**, stain the biofilm, making it visible to both the clinician and patient. This not only aids the clinician in precisely identifying the affected areas but also enhances **patient education**, as they can see the biofilm and understand the importance of maintaining oral hygiene (Yin et al., 2023). This visual feedback is one of the most powerful tools in improving patient compliance with post-treatment care.

Once the biofilm has been identified, the next step involves the use of **air-polishing devices**. These devices use a jet of air combined with **glycine** or **erythritol powder**, which are much less abrasive than the traditional sodium bicarbonate powder used in older polishing techniques. The fine powder is effective in disrupting and removing the biofilm without damaging the tooth surface or surrounding soft tissue. Studies have shown that **erythritol powder**, in particular, is highly effective at removing biofilm and has the added benefit of being **less abrasive** than other powders, which makes it suitable for sensitive patients and those with exposed root surfaces (Rajesh et al., 2023).

Components of Guided Biofilm Therapy

Disclosing Agents

One of the first and most crucial steps in Guided Biofilm Therapy is the use of **disclosing agents**. These agents, often in the form of dyes like **gentian violet** or **erythrosine**, are applied to the teeth to highlight the biofilm. These agents work by staining the bacterial plaque, turning it a noticeable color, which makes it easy for the clinician to see exactly where the biofilm is located. Not only does this step allow for precise targeting of the treatment areas, but it also plays a significant role in **patient education**. By showing the

patient where plaque and biofilm have accumulated, clinicians can better emphasize the importance of good oral hygiene practices at home (Sikder et al., 2021).

The use of disclosing agents has a profound impact on treatment outcomes, as it ensures that no areas are missed during the treatment process. These agents are especially beneficial in areas that are difficult to clean or in patients with complex oral conditions, such as those with deep periodontal pockets or those who have had previous periodontal surgeries (Rajesh et al., 2023).

Air-Polishing Devices

Another fundamental component of GBT is the **air-polishing device**. These devices use a controlled jet of air to deliver fine particles of abrasive powder, such as **glycine** or **erythritol**, to the tooth surfaces. The **supragingival nozzles** are typically used to remove plaque and stains from the crown and visible tooth surfaces, while **subgingival nozzles** are specifically designed to clean beneath the gumline and into deeper pockets, removing biofilm and calculus from areas that are often inaccessible with traditional methods (Shrivastava et al., 2021).

The **erythritol powder** used in GBT is especially advantageous due to its **low abrasiveness**, making it suitable for both **healthy** and **sensitive** teeth. Unlike sodium bicarbonate, erythritol is less likely to cause damage to the soft tissue, reducing the risk of gingival recession and discomfort during treatment (Rajesh et al., 2023). Furthermore, erythritol has been shown to reduce the number of pathogenic bacteria, such as *Porphyromonas gingivalis*, which are directly implicated in periodontal diseases, making it a key player in biofilm management (Yin et al., 2023).

Specialized Scaling Tips

Finally, the use of **specialized scaling tips** in GBT plays a vital role in achieving thorough biofilm removal. The **PIEZON LED tip** is particularly effective in scaling and cleaning deeper pockets, as it combines the precision of ultrasonic scaling with the benefits of LED lighting, which helps illuminate the treatment area for better visibility. These tips are designed to access hard-to-reach areas in the periodontal pocket while minimizing discomfort for the patient. By using these tips in conjunction with air-polishing devices, clinicians can ensure that both supra- and subgingival biofilms are completely removed, leading to better treatment outcomes and faster healing (Shrivastava et al., 2021).

Clinical Applications of Guided Biofilm Therapy (GBT)

Treatment of Periodontal Diseases

Guided Biofilm Therapy (GBT) has shown remarkable efficacy in treating **mild to moderate periodontitis**. One of the key advantages of GBT over traditional scaling and root planing (SRP) is its precision. The targeted removal of biofilm using disclosing agents allows clinicians to focus treatment on the exact areas that need it, ensuring that no part of the biofilm is left behind. This is crucial for patients with periodontal disease, where biofilm accumulation is often the primary contributor to tissue inflammation and bone loss (Rajesh et al., 2023).

Clinical studies have demonstrated significant **reduction in pocket depth**, a critical metric in assessing periodontal health. The use of air-polishing devices with low-abrasive powders like erythritol effectively removes biofilm, which helps in reducing **bleeding on probing (BOP)** and **inflammation** in periodontal tissues. As the biofilm is removed, bacterial load decreases, allowing for faster healing and better tissue response (Yin et al., 2023). Additionally, compared to traditional SRP, GBT offers a **minimally invasive approach** that reduces discomfort during and after the treatment. This makes it an ideal option for patients with mild to moderate periodontitis who may experience significant discomfort with traditional methods (Shrivastava et al., 2021).

Peri-Implant Diseases

The management of **peri-implant diseases**, such as **peri-implantitis** and **peri-mucositis**, has traditionally been more difficult due to the unique nature of implants and their surrounding tissues. Peri-implantitis, an infection of the tissues surrounding a dental implant, can lead to bone loss and implant failure if left untreated. However, GBT has emerged as a promising approach for treating these conditions. The use of air-polishing devices, particularly with erythritol powder, helps to gently remove biofilm from the implant surface without causing harm to the implant or surrounding tissue (Liu et al., 2024).

The precision offered by GBT ensures that only the affected areas are treated, preserving the integrity of the implant and surrounding tissues. This is crucial because traditional mechanical cleaning methods can sometimes damage the delicate surface of the implant, which can compromise the long-term success of the implant (Shrivastava et al., 2021). GBT not only helps in biofilm removal but also reduces **inflammation** and **bleeding**, promoting faster healing of the peri-implant tissues. In cases of **peri-mucositis**, where the soft tissue

around the implant becomes inflamed but the bone is still intact, GBT can significantly reduce inflammation, offering a non-invasive solution to manage the disease before it progresses to peri-implantitis (Rajesh et al., 2023).

Maintenance Therapy

GBT plays a crucial role in **long-term periodontal maintenance**. For patients who have already undergone periodontal therapy, regular GBT sessions help maintain the results by keeping biofilm buildup at bay. This is particularly important in patients who have a history of periodontal disease or those with high susceptibility to plaque accumulation (Shrivastava et al., 2021). The use of disclosing agents during follow-up visits allows the clinician to visualize the biofilm that may have developed between appointments, ensuring that no areas are missed and biofilm is effectively managed.

Advantages of Guided Biofilm Therapy

Improved Patient Comfort

One of the most significant advantages of **GBT** over traditional methods is the **improved patient comfort** it provides. Traditional scaling and root planing (SRP) can be uncomfortable, especially for patients with sensitive teeth, deep periodontal pockets, or extensive biofilm buildup. The use of air-polishing devices and specialized tips in GBT reduces the need for manual scaling and provides a gentler approach to biofilm removal. This minimizes the risk of discomfort, **pain**, and **gingival recession**, which are often associated with SRP (Rajesh et al., 2023).

Efficiency and Reduced Treatment Time

GBT significantly **reduces treatment time** compared to traditional SRP. Air-polishing devices enable a more efficient removal of biofilm and plaque, meaning that treatment can be completed in less time. Additionally, because GBT is a more targeted approach, there is less need for lengthy manual cleaning or the repetitive use of ultrasonic instruments, further cutting down on the overall treatment time (Rajesh et al., 2023). This increase in efficiency is particularly beneficial for both clinicians, who can treat more patients, and patients, who experience less time spent in the dental chair.

GBT vs. Traditional SRP

Comparison of Clinical Outcomes

The comparison between **Guided Biofilm Therapy (GBT)** and **Scaling and Root Planing (SRP)** in terms of clinical outcomes has become an important area of research in the field of periodontics. Both methods aim to reduce the microbial load in periodontal pockets and improve patient outcomes, but they differ significantly in terms of the techniques used and the outcomes achieved. Several clinical studies have shown that **GBT** is comparable, if not superior, to **SRP** when it comes to **pocket depth reduction** and **bleeding on probing (BOP)**.

In a clinical trial by **Rajesh et al. (2023)**, GBT was shown to result in a more substantial reduction in probing pocket depths, especially in areas that are typically difficult to clean, such as the furcation areas or deep periodontal pockets. Traditional SRP, while effective in removing calculus, often leaves residual biofilm behind, which can contribute to disease recurrence. In contrast, GBT uses **disclosing agents** to visualize biofilm, ensuring complete biofilm removal. This precision results in better clinical outcomes, with studies indicating a **more significant decrease in BOP** after GBT than after SRP (Shrivastava et al., 2021).

Advantages of GBT over SRP

The **advantages of GBT** over traditional SRP are multifaceted, particularly in terms of **speed**, **comfort**, and **less invasiveness**. One of the most notable benefits of **GBT** is its ability to **reduce treatment time**. The use of air-polishing devices enables a faster and more efficient removal of biofilm, which is particularly beneficial for patients with widespread plaque accumulation. In contrast, SRP can be more time-consuming, especially in deep pockets or when extensive plaque removal is required (Rajesh et al., 2023). By streamlining the cleaning process, GBT minimizes the time patients spend in the dental chair, making it a more convenient option for both clinicians and patients.

CONCLUSION

Summary of Key Findings

The review of **Guided Biofilm Therapy (GBT)** has highlighted its significant advantages in treating periodontal diseases. **GBT** not only provides a more **precise and effective method** for **biofilm removal** but also reduces **patient discomfort** and **treatment time** compared to traditional methods like **scaling and root planing (SRP)**. Clinical outcomes, such as **reduced pocket depths**, **decreased bleeding on probing**, and **reduced inflammation**, have demonstrated that **GBT** is a powerful alternative to conventional treatment methods.

Additionally, the gentle nature of the treatment makes it especially suitable for patients with **sensitive teeth** or **complicated oral conditions**, including those undergoing **implant therapy** (Rajesh et al., 2023).

Implications for Future Periodontal Care

The potential of **GBT** to **complement or even replace traditional periodontal treatments** is significant. As a less invasive, more **patient-friendly option**, it offers an ideal solution for **non-surgical periodontal therapy**. However, for it to be considered the **gold standard**, more long-term studies are required to validate its effectiveness in maintaining **periodontal health** and preventing disease recurrence. If future research confirms these results, **GBT** could become the go-to treatment for a variety of periodontal and peri-implant diseases (Shrivastava et al., 2021).

Recommendations for Practice

Based on the benefits outlined in this review, clinicians are encouraged to **adopt GBT** in their periodontal practices, particularly for **mild to moderate cases** of **periodontitis** and **peri-implant diseases**. The ability to visualize biofilm, combined with **minimally invasive biofilm removal**, provides an opportunity to achieve **better clinical outcomes** while enhancing **patient satisfaction**. However, before widespread implementation, it is important for clinicians to receive proper training in **GBT techniques** to maximize its potential. Continued research into its **long-term efficacy** and **expanded applications** will further solidify its place in modern periodontal care (Yin et al., 2023).

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