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Current Evidence of Antibiotics as Adjunctive Therapy in Peri-Implant Diseases: A Review

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ABSTRACT

Introduction: *Dental implants are a reliable and commonly used procedure in clinical practice for replacing missing teeth. Nevertheless, they are not free of complications, with peri-implant mucositis and peri-implantitis being possible issues that can arise. Different treatments have been suggested to both prevent and manage peri-implant diseases. These therapeutic approaches encompass non-surgical and surgical methods, and numerous adjunctive therapies have been proposed to potentially enhance their effectiveness, leading to clinical and microbiological improvements in these conditions.*

Methods: *A comprehensive literature review was carried out, involving recent articles of scientific significance obtained through searches in various indexed databases, including PubMed.*

Results: *35 articles that report that antibiotic therapy is a valid adjunctive alternative for peri-implantitis were found.*

Conclusions: *The placement of dental implants can potentially result in future peri-implant diseases, and as of now, there is no definitive treatment guide available. Nevertheless, recent studies have highlighted the crucial role of eliminating bacterial biofilm from the implant surface in peri-implantitis treatment. This decontamination process, whether achieved through surgical or non-surgical methods, must be complemented with antimicrobial therapeutic approaches.*

Keywords

Peri-implantitis, Peri-implant diseases, Antibiotic therapy, Local antibiotics, Systemic antibiotics.

Introduction

As defined by the World Health Organization (WHO), oral health encompasses the condition of the mouth, teeth, and orofacial structures, enabling individuals to perform fundamental functions such as eating, breathing, and speaking. Furthermore, it profoundly influences psychosocial dimensions including self-confidence, overall well-being, and the ability to engage in social and occupational activities free from pain, discomfort, or embarrassment [1]. Oral health experiences variations throughout life, from early childhood to old age; it constitutes an integral component of overall health, facilitating individuals' active participation in society. This crucial aspect of health can be compromised by oral conditions or diseases that contribute to the deterioration of different oral structures. Currently, oral diseases are highly prevalent on a global scale, exerting a substantial impact on the economy, public health, and quality of life of patients. Among these, dental caries and periodontal diseases are the most common causes of tooth loss [1], while oral cancer can result in more severe consequences, including mortality [2].

At present, there are many treatments available to replace lost teeth, including fixed and removable partial dentures, as well as dental implants. The use of dental implants has seen a steady increase in popularity over the years, especially since the introduction of the concept of osseointegration by Bränemark. In recent years, implants have gained significant momentum as a fixed option that closely mimics natural teeth. This not only eliminates the need to modify or prepare healthy teeth but also facilitates the use of oral hygiene tools and techniques. As a result, dental implants have become the preferred treatment choice for many patients and professionals. However, with the growing demand for dental implants, there has also been an increase in their failure rates. Despite their extensive use and the advancement of technology, failures continue to occur [3]. The most common causes of implant loss are peri-implant diseases, which include peri-implant mucositis (characterized by reversible inflammation of the tissue surrounding the implant without bone tissue loss) and peri-implantitis (an inflammatory process affecting the physiological function of hard and soft tissues surrounding an osseointegrated implant, potentially leading to its loss) [4].

Several treatments have been proposed to prevent and treat peri-implant diseases, but their prevalence remains very high. Most studies available indicate that the primary goal of treating peri-implantitis is the mechanical removal of biofilm from the implant surface. However, the results of such treatments are controversial, and alternative approaches have been suggested, including surgical procedures and chemical adjuvants. Some authors have proposed the use of antibiotics as potential adjuvants for controlling or treating peri-implant diseases. Local or topical antibiotics like minocycline, tetracycline, azithromycin, amoxicillin, doxycycline, and metronidazole may enhance treatment effectiveness, although it is evident that further conclusive research and clinical studies are needed to validate their application [5].

Conversely, some authors have reported that treatment involving systemic antibiotics like amoxicillin/metronidazole, as the only intervention, does not significantly improve clinical and microbiological outcomes in cases of peri-implant diseases [6]. Furthermore, the use of systemic antibiotics as a supplementary therapy to surgical interventions for peri-implantitis cannot be universally justified within a standard treatment protocol due to the absence of uniform diagnostic criteria, insufficient patient characteristic data, and lack of high-quality, long-term randomized controlled trials. Additionally, current reports suggest that their effectiveness is limited [7].

The objective of this literature review is to examine the available evidence justifying the use of antibiotics as adjuncts to both surgical and non-surgical mechanical therapy in managing peri-implant diseases.

Epidemiology of Peri-Implant Diseases

After the insertion of an implant into the residual bone, a healing process known as osseointegration takes place. This process involves the formation of peri-implant hard and soft tissues, with the development of new bone in direct contact with the implant's surface [3]. Once this process concludes, the dental implant can either remain in a healthy state or potentially develop peri-implant disease. Peri-implant health is defined by the absence of clinical signs of inflammation, such as swelling, redness, and bleeding upon probing. Nevertheless, establishing a specific range of probing depths on implants that signifies health or disease presence has proven challenging. Similar to gingivitis and periodontitis in natural teeth, inflammation involving the soft and hard tissues surrounding dental implants can occur, resulting in peri-implant mucositis and peri-implantitis, respectively. Mucositis is characterized as a reversible inflammatory process induced by bacteria in the peri-implant soft tissues, manifesting as redness, inflammation, and bleeding upon probing [8]. Research has demonstrated that mucositis often precedes peri-implantitis, particularly in patients lacking regular maintenance appointments, which are typically recommended at intervals of every 3 months [9].

On the other hand, peri-implantitis is described as an infectious, progressive, and irreversible pathological condition affecting both peri-implant soft and hard tissues. It may entail bone loss, bleeding, pain, mobility, drainage, and increased probing depths [2]. While the etiology of these peri-implant diseases is multifactorial, they primarily depend on the bacterial environment and the immune status of the host. The prevalence of peri-implant mucositis and peri-implantitis can vary significantly, ranging from 5% to 63.4%. This wide range is attributed to differences in study designs, sample sizes, and patient characteristics. It is reported that after ten years, approximately 10% to 50% of dental implants may exhibit signs of peri-implantitis, and up to 80% may develop mucositis [1].

Treatment of Peri-Implant Diseases

Peri-implant diseases are the primary cause of dental implant loss. The literature suggests that the primary objective of treatment should be the prevention and detection of the progression of these diseases [2]. Treatment options encompass both non-surgical and surgical methods, and various adjunctive therapies have been proposed to enhance their effectiveness and yield clinical and microbiological improvements.

Non-surgical treatments consist of closed-field mechanical debridement, the use of systemic antibiotics in conjunction with mechanical therapy, and the utilization of chemical agents for detoxifying the implant surface, among other approaches [10]. On the other hand, surgical treatments include open-field mechanical debridement, implantoplasty, the use of chemical agents in open-field procedures, guided bone regeneration, and the application of topical antibiotics, among other techniques [11].

Peri-implantitis is primarily caused by bacteria, therefore, the success of the treatment depends mainly on stopping the inflammatory process through effective control of the infection and elimination of the biofilm on the surface of the implant [12]. Therapeutic approaches currently used include modifying the oral microbiota, and among these approaches are resective or

regenerative techniques. However, these therapeutic strategies are not consistently reliable in halting inflammation of peri-implant tissues, and current evidence does not endorse a standardized treatment protocol [13].

While there are still no comprehensive clinical guidelines, managing peri-implantitis has traditionally involved a treatment approach similar to that used for periodontitis. Despite extensive research into various techniques, a consensus or widely accepted treatment that reliably produces predictable outcomes remains elusive [12].

Some treatment approaches, as suggested by numerous studies, appear to have the potential to stop or slow down the deterioration of peri-implant support tissues. The decision-making process for treating peri-implantitis can take into account factors such as the configuration of the peri-implant bone defect and the patient's local and systemic conditions [11,13-15].

Various treatment protocols propose the use of different tools and techniques, including curettes, ultrasound, air polishing devices, lasers, and antimicrobial agents like metronidazole, minocycline, doxycycline, and chlorhexidine, for both surgical and non-surgical management of peri-implantitis. The success of treatment should be evaluated based on the resolution of clinical signs of the disease, primarily achieving a clinical probing depth (CPD) of 5 mm or less, the absence of bleeding on probing (BOP), and suppuration on probing (SOP), and absence of bone loss exceeding 0.5 mm [11].

Different adjunctive therapies have been suggested to complement surgical or non-surgical mechanical procedures in the treatment of peri-implant diseases. One of these therapies, which has gained increasing attention in the literature, is the use of locally or systemically administered antibiotics in conjunction with periodontal treatment, whether surgical or non-surgical [4].

Non-Surgical Treatment of Peri-Implant Diseases

The non-surgical strategy primarily aims to reduce inflammation by controlling bacterial colonization of implant surfaces. This is achieved through the use of specialized tools to mechanically remove biofilm, as well as the application of antibiotics, antiseptics, or laser decontamination. Therefore, non-surgical intervention is often considered the initial step in treating this disease [13].

The most commonly employed non-surgical treatment for eliminating biofilm in peri-implantitis is scaling and planing, which can be carried out using manual or ultrasonic instruments. However, the design of the implant structure, with its intricate threads, can pose challenges for mechanical procedures in completely eradicating the biofilm [16]. As a result, the administration of antibiotics has been considered beneficial in managing intraoral biofilm and as an adjunct to manual therapy for clinical control [17].

The existing literature provides information on several medications for the treatment of peri-implantitis, including those for local administration and others for systemic use. For local administration, the following medications have been reported: Minocycline (Arestin and Periocline), Doxycycline (Atridox and Ligosan), Lincomycin, Erythromycin, Tetracycline (Actisite), and Metronidazole (Elyzol) [4,5,15,18]. In terms of systemic medications, the following have been reported: Azithromycin, Metronidazole, Amoxicillin, Clindamycin, Tetracycline, Ciprofloxacin, Sulfonamide, Trimethoprim, and Ornidazole [6,7,,15,19,20]. These medications are available in numerous administration vehicles, including gel, chips, ointment, microspheres, powder, and fibers, each with different dosages. See Table 1.

Table 1: Antibiotics used in the therapy of peri-implant diseases according to their route of administration.

Antibiotics	Local	Systemic	References
Minocycline	X		(5,18,21)
Doxycycline	X		(5,18,21)
Lincomycin	X		(18)
Erythromycin	X		(18)
Tetracycline	X	X	(18,21)
Metronidazole	X	X	(5,19,21,22)
Azithromycin		X	(7,19,21)
Amoxicillin		X	(7,19,21)
Clindamycin		X	(19,23)
Ciprofloxacin		X	(5,23)
Sulfonamide		X	(23)
Trimethoprim		X	(23)
Ornidazole		X	(24)

Source: self-made.

When assessing the outcomes of nonsurgical therapy, the available data do not offer predictable protocols, regardless of the decontamination method employed. Surgical approaches have been suggested, particularly for cases with more severe bone defects [11]. Incomplete implant decontamination represents the main reason for the poor predictability of this type of treatment, due to the complex micro and macro topography of the implant interfaces and structural configuration [13].

Non-surgical approaches should be primarily reserved for managing peri-implant mucositis. In situations involving significant bone loss characteristic of peri-implantitis, non-surgical therapy often falls short in resolving the lesions resulting from the inflammatory process [5].

Surgical Treatment of Peri-Implant Diseases

The selection of the specific surgical protocol depends on the configuration and severity of the peri-implant defect [3,11]. Following an initial phase that involves providing instructions for proper oral hygiene, controlling risk factors, and performing

supragingival instrumentation, implants affected by persistent probing depths and progressive bone loss will require surgical intervention, whether access, resection, or reconstruction [15,21-25]. The main goals of surgical management are to reduce the bacterial load and restore peri-implant clinical health. Recent findings highlight that the nature of the bone defect around an implant with peri-implantitis can significantly influence the therapeutic outcomes [3].

The surgical treatment of peri-implantitis begins with the elevation of a full-thickness flap to gain access to the contaminated surface of the implant. This is followed by the debridement of the peri-implant soft tissue defect and a meticulous decontamination process to cleanse the implant surface. It is often recommended to employ a combination of mechanical and chemical decontamination methods before assessing the configuration of the peri-implant bone defect. Following the decontamination of the implant surface, four surgical modalities have been described for treating peri-implant bone defects [3,20].

Open Flap Debridement without Resection

This modality involves elevating a mucoperiosteal flap and removing granulomatous tissue to access the contaminated implant surface. After the removal of inflammatory tissue, the implant surface is thoroughly decontaminated through mechanical, chemical, and additional methods if necessary. Finally, the flap is closed using sutures [3].

Open flap debridement and resection

This modality involves the elevation of a mucoperiosteal flap, along with resection and bone recontouring, and may also include the administration of systemic or local antibiotics as supplementary treatments [18]. Several studies have indicated that implants with a modified surface have a higher risk of disease progression when compared to implants with an unmodified surface. Implantoplasty, which is defined as the removal of the supracrestal threads of the implant and the exposed surface, can be performed as part of the resection treatment. Its purpose is to modify the topography of the implant surface, making it easier to remove biofilm. However, there is controversial evidence regarding the advantages of implantoplasty procedures, primarily due to the lack of clinical evidence and a consensus among studies [3,11,26].

Reconstructive Procedures

Reconstructive protocols involving the use of autogenous bone, different bone substitutes, and barrier membranes have been suggested in numerous studies to treat peri-implantitis defects. However, in a systematic review focused on assessing disease resolution, no significant differences were observed in the clinical parameters assessed (CPD and BOP) when comparing a reconstructive approach to open flap debridement [3,11,26].

Combined Resection and Reconstructive Procedures

The term "combined resection and reconstruction" describes a treatment approach that involves both the removal of affected tissue (resection) and the rebuilding of peri-implant structures (reconstruction) [27]. Clinical and radiographic outcomes of this combined approach were reported in a case series study, specifically in the context of managing two- and three-wall peri-implantitis defects. In follow-up examinations conducted at 6 and 12 months after treatment, improvements were noted in clinical parameters (CPD and BOP). However, a significant soft tissue recession of 2.5 mm was also observed, indicating limited clinical efficacy. As a result, this combined surgical approach may be more suitable for posterior sectors where very high aesthetic standards are not as critical [3].

There is evidence of other types of treatment for peri-implant diseases. Mechanical treatments encompass methods like curettes, ultrasound, saline irrigations, air powder abrasion, titanium brushes, and implantoplasty. Chemical treatments involve the use of substances such as citric acid, chlorhexidine, enamel matrix derivatives (EMD), and topical or systemic antimicrobials. In addition, physical treatments like laser therapy and photodynamic therapy have also been suggested as therapeutic options. These therapies have been proposed in the literature, both as standalone treatments and in combination [12].

Optimal mechanical decontamination should not only effectively remove hard deposits and biofilms but also strive to prevent detrimental changes to the implant surface. Metal curettes and ultrasonic scaler tips are among the most frequently employed mechanical debridement devices, primarily focusing on removing hard deposits from the implant Surface [4]. However, it's worth noting that in vitro studies have suggested that non-metallic curettes and rubber cups, while minimally traumatic, may be less effective in thoroughly cleaning contaminated titanium surfaces [12].

Combining mechanical instruments with chemical agents can enhance treatment outcomes because the chemical agent can reach mechanically inaccessible areas. The most commonly used agents are sterile saline solution (SS), which is a conservative strategy recommended for use in combination with other approaches, and citric acid (CA), which offers antimicrobial properties, minimal alterations, and improved wettability for reosseointegration. On the other hand, Ethylenediaminetetraacetic Acid (EDTA) has limited antimicrobial activity, but it can weaken bacterial cell membranes, working in conjunction with other chemicals. For example, it can be used in combination with chlorhexidine (CHX), which is more effective at targeting bacterial cell walls. Phosphoric acid (PA), is another commonly used agent, it has antiseptic effects but has been tested in very few studies. Finally, CHX gluconate is considered a broad-spectrum antiseptic with a pronounced antimicrobial effect on Gram-negative and Gram-positive bacteria, as well as fungi and some viruses but existing evidence does not support the use of CHX as an adjuvant agent to promote implant decontamination or reosseointegration [28].

The disruption of periodontal homeostasis between the host and the microbiome influences peri-implantitis, mirroring the dynamics seen in periodontal disease. This disturbance triggers

a destructive inflammatory response driven by the synergistic virulence of involved bacteria. This inflammatory process can lead to dysbiosis, and systemic complications may be seen along with tooth loss and implant failure [5]. Recent studies have identified various bacterial species, including Tannerella forsythia and Porphyromonas gingivalis, as contributors to peri-implantitis. A systematic review and meta-analysis, comparing peri-implantitis lesions with a control group of individuals with healthy implants, revealed a higher prevalence of Prevotella intermedia, Tannerella forsythia, and Aggregatibacter actinomycetemcomitans in association with peri-implantitis [5].

Peri-implantitis presents as a diverse mixed infection, comprising periodontopathic microorganisms, non-culturable anaerobic asaccharolytic gram-positive bacilli, other non-culturable gram-negative bacilli, and occasionally opportunistic microorganisms like enteric bacilli and Staphylococcus aureus. These intricate bacterial communities pose challenges for biofilm removal, which means that mechanical protocols for cleaning the exposed implant surface have limitations. To address this, the complementary use of antimicrobials has been suggested to enhance implant decontamination and treatment response. Local application of antibiotics, in conjunction with mechanical decontamination methods, is the preferred approach in treating peri-implantitis to minimize the undesired effects associated with systemic antibiotics [11].

The Cumulative Interceptive Supportive Therapy (CIST) protocol emerges as a promising alternative in managing peri-implant disease, with its applicability dependent on the severity level. The primary therapeutic goal revolves around reducing peri-implant inflammation and ideally promoting the regeneration of peri-implant tissues. The CIST protocol is based on regular patient reviews and frequent assessments of key parameters, including biofilm presence, bleeding, suppuration, periodontal pockets, and radiographic evidence of bone loss. A crucial component of this approach involves the administration of local and systemic antibiotics, serving as a foundational step to potentially avoid or delay the need for regenerative or resective surgical procedures [5].

Local Antibiotics as the Only Treatment for Peri-Implantitis

Adjuvant treatment with antibiotics can have a positive effect on treatment results and local administration of antibiotics allows maintaining high concentrations in a peri-implant bone defect, thus reducing CPD and BOP [18]. Currently, few studies indicate a significant improvement in CPD, BOP, and biofilm index with the use of local antibiotics alone [14,15,17,22], except for one study where it was reported that the use of local antibiotics in implants with peri-implantitis positively affected the reduction of CPD and BOP [18].

Use of Local Antibiotics in Combination with Surgical and Non-Surgical Therapy for the Treatment of Peri-Implantitis

Some studies have investigated the effectiveness of using local antibiotics in combination with surgical and non-surgical treatment for peri-implantitis. These studies report that this adjunctive therapy always results in reductions in BOP and CPD for up to 12 months [5,7,29], and in some cases in improvements in clinical attachment level (CAL), gingival index (GI), and biofilm index [29]. This improvement is more significant than non-surgical treatment alone [5].

According to a study conducted by Toledano et al., a comparison was made between groups where local antibiotics were administered and those where scaling and planning were performed alone. The experimental groups showed an average reduction of 0.3 mm in CPD and BOP was reduced by up to 50% with the use of local antibiotics [18].

According to a systematic review and meta-analysis published by Osorio et al. in 2021, the authors suggest that local administration of antibiotics reduced CPD and BOP without adverse effects, an additional reduction of 0.30mm can be expected when antibiotics are used, and an almost double chance of bleeding when antibiotics are not applied locally [18]. Topical application of antibiotics, in many cases, requires exposure of the implant surface and bone defect [19].

Local antibiotics as an adjunctive therapy alongside mechanical debridement have yielded promising yet non-significant results. Consequently, local antibiotics have the potential to significantly enhance the management of peri-implant disease when compared to mechanical debridement alone, improving the effectiveness of surgical interventions. The application of antimicrobial agents locally during periodontal surgical procedures may lead to improved outcomes. This is supported by the findings of Mombelli et al., who reported enhancements in both clinical and microbiological parameters in the treatment of peri-implantitis through the topical application of tetracycline [5].

Use of Systemic Antibiotics in Combination with Surgical and Non-Surgical Therapy for the Treatment of Peri-Implantitis

Many surgical treatment protocols for peri-implantitis recommend the adjunctive use of systemic antibiotics to potentially reduce specific bacterial counts, suggesting that antibiotics may be necessary to effectively address the infection [19]. The main mechanism of action for systemic antimicrobials involves delivering the drug through the bloodstream to the target organ. Moreover, systemic administration of antibiotics offers higher bioavailability in oral tissues, leading to oral disinfection irrespective of the location of the peri-implant pocket. Some authors argue that systemic antimicrobial administration is the standard approach in treating peri-implant diseases [19].

In this context, the combination of Amoxicillin with Metronidazole, with varying dosages and durations, has been frequently reported as an adjuvant to both surgical and non-surgical treatments due to its favorable outcomes [30]. Several studies have demonstrated its ability to reduce BOP, CPD, and suppuration, and improve CAL, recession, and bacterial counts in patients with peri-implantitis [21,31]. However, it's worth noting that some studies have not found significant differences in its effectiveness [6]. The implementation of this antibiotic regimen may be more beneficial for specific

patient groups and implants with particular characteristics [7,31]. Nevertheless, the issue of antibiotic administration remains highly controversial in the literature, and further studies are needed to confirm its efficacy [15]. Concerns also exist regarding its limited clinical applicability due to the potential development of bacterial resistance [7,9,32]. While these antibiotics are considered beneficial in terms of clinical treatment, biofilm control, and radiographic bone regeneration, they have been associated with side effects such as dysbiosis, antibiotic resistance, and gastrointestinal issues [18].

Systemic antibiotics can potentially interact with other medications, leading to comorbidity, serious adverse events, increased proliferation of antimicrobial resistance, and the development of superinfections. Additionally, they can contribute to the overgrowth of opportunistic pathogens that are challenging to eliminate. It's crucial to weigh these risks, particularly when prescribing more than one antibiotic concurrently. A systematic review and meta-analysis conducted by Manuel Toledano et al. have yielded specific conclusions regarding the use of systemic antibiotics in patients with peri-implantitis. The existing scientific evidence suggests that systemic antibiotics may not significantly reduce either BOP or CPD in these patients. However, they can produce significant results, such as decreased clinical attachment loss, reduced suppuration and recession, diminished bone loss, and a lower total bacterial count. These findings emphasize the complex interplay between systemic antibiotics and their impact on numerous clinical parameters in the context of peri-implantitis management [19].

Different contemporary studies provide substantial evidence that the treatment of peri-implantitis requires the removal of bacterial biofilm from the implant surface, regardless of whether it is achieved through surgical or non-surgical treatment. Moreover, these approaches should be complemented by chemical adjunctive therapies [5].

Discussion

The current literature review reveals that local and systemic antibiotics have been suggested for use in both surgical and non-surgical approaches to managing peri-implant diseases.

Among the many antimicrobial therapies considered, the supplementary use of systemic antibiotics has been subject to evaluation. In a randomized clinical trial conducted by Carcuac et al. [31] involving 100 patients undergoing surgical peri-implantitis treatment, participants were divided into four groups: those receiving systemic antibiotic treatment (amoxicillin 750 mg/12 h) along with chlorhexidine; those receiving systemic antibiotics without chlorhexidine; those treated with chlorhexidine alone, and those receiving neither antibiotics nor antiseptics. After a 12-month follow-up, the treatment success rate was 45%, indicating a potential benefit of antibiotics in patients with peri-implantitis. However, a three-year follow-up of the same study revealed that the treatment success rate had declined to 33% for all treated implants, suggesting that the potential advantages of systemic antibiotics may not be sustained over the long term [31].

Given that peri-implantitis is an infection-driven condition, both local and systemic antimicrobial treatments have been proposed as complementary methods for decontamination. In a randomized clinical trial conducted by Cha et al., they investigated the additional effect of locally applied minocycline during surgery (followed by submucosal applications at 1- and 3 months post-surgery). The results demonstrated statistically significant bone gain compared to a placebo group and achieved the highest treatment success rate among all the trials included, with a success rate of 66.7% [26].

When it comes to the systemic administration of antimicrobials, meta-analyses reported in the systematic review by Mario Aimetti et al. identified a higher likelihood of treatment success when systemic antibiotics were used. However, it's crucial to conduct a thorough risk/benefit assessment before opting for systemic antimicrobial treatment, considering the potential for side effects and the emerging problem of antibiotic resistance [19].

In certain studies conducted by Schwarz F et al. and Deeb MA et al., various treatment protocols have been suggested, employing diverse tools and methods such as curettes, ultrasound, air polishing devices, lasers, or antimicrobial agents like metronidazole, minocycline, doxycycline, and chlorhexidine for both surgical and non-surgical treatment of peri-implantitis [32,33]. When evaluating the outcomes of non-surgical therapy, it becomes evident that there are no universally predictable protocols, regardless of the decontamination method used [28]. Consequently, surgical approaches have been proposed, particularly for cases involving more advanced and complex defects [33]. The choice of the specific surgical protocol can be influenced by the configuration and severity of the peri-implant defect [34].

Additional therapies for peri-implantitis are documented in the literature. However, there is insufficient evidence regarding their efficacy when used in conjunction with antibiotics. Examples of these alternative therapies include antimicrobial photodynamic therapy, which has shown effectiveness in eradicating oral pathogens [35], as well as techniques involving abrasion with air dust, titanium brushes, the application of citric acid, enamel matrix derivatives (EMD), laser treatments, among others [25].

Another method of adjunctive therapy, as described by Agurne Uribarri et al., has been documented. They detail a combined surgical approach involving implantoplasty along with the filling of infrabony defects, in conjunction with the use of antibiotics. This technique encompasses implantoplasty of the suprabony segment, addressing buccal or lingual dehiscence, and concurrently reconstructing the infrabony defect using a bone substitute and a resorbable membrane. Remarkably, the results, as observed over a seven-year follow-up period, revealed that 79% of the 15 patients achieved resolution of the disease. It's worth noting that such adjunctive therapy with antibiotics is not commonly reported in the literature, emphasizing the potential for its optimization through further comparative studies that yield conclusive results [27].

Additional studies with consistent designs and extended follow-up periods are needed to evaluate various antibiotic therapies, both systemic and local, involving different dosages and controlled release mechanisms. Conducting precise comparisons of the effects of antibiotics could lead to the development of a validated and definitive treatment protocol for peri-implantitis.

Conclusion

In summary, the placement of dental implants can potentially result in future peri-implant diseases, and as of now, there are limited studies that offer a definitive and safe treatment guide for peri-implantitis. Nevertheless, numerous recent studies have highlighted the crucial role of eliminating bacterial biofilm from the implant surface in peri-implantitis treatment. This decontamination process, whether achieved through surgical or non-surgical methods, must be complemented with antimicrobial therapeutic approaches to effectively manage peri-implantitis.

Research has demonstrated that the use of both local and systemic antibiotics yields positive clinical outcomes in peri-implantitis treatment. Nonetheless, it is essential to consider that minimizing the prescription of systemic antibiotics can play a role in addressing the issue of antibiotic resistance. However, it is important to note that no conclusive protocol supported by robust scientific evidence has emerged from the studies conducted to date. Therefore, there is a pressing need for additional research with consistent study designs and extended follow-up periods. Such studies are crucial as they can potentially establish a definitive and evidence-based treatment protocol for managing peri-implantitis.

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