



## Treatments Of Periodontitis : A Review Of Non Surgical Treatments to Surgical Treatments with Recent Advances

Jyoti Talageri<sup>1</sup>, Dr. Vishnu A. Kangralkar<sup>2</sup>, Dr. Sambrekar S.N<sup>3</sup>

<sup>1</sup>Department of Pharmacology, Maratha Mandal college of Pharmacy, Rajiv Gandhi University of health sciences, Karnataka, Bengaluru 4th block, Jayanagar, Bengaluru – 560041.

<sup>2</sup>M.Pharm, Ph.D, Principal & HOD, Department of Pharmacology, Maratha Mandal college of Pharmacy, Rajiv Gandhi University of health sciences, Karnataka, Bengaluru 4th block, Jayanagar, Bengaluru – 560041.

<sup>3</sup>Department of Pharmacology, Maratha Mandal college of Pharmacy, Rajiv Gandhi University of health sciences, Karnataka, Bengaluru 4th block, Jayanagar, Bengaluru – 560041.

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### ABSTRACT:

Periodontal disorders are pathological problems characterized by infection or inflammation of the periodontium, which is the connective tissue that provides support for the teeth. This condition is a common illness affecting over 40 percent of adults in the USA. Its most serious form approximately 11% prevalent worldwide. Advanced cases of periodontitis results in the loss of teeth and decline in life quality. A precise assessment, an elimination of underlying reasons, and the mitigation of modifiable danger indicators are the key elements for successful periodontal prevention and therapy. For evaluate, treat, and manage periodontal disease the pitiful attempt is made to incorporate certain non surgical to surgical with recent advances in treatment of periodontitis. The treatments include, non surgical home care review, scaling and root planning, prescription antibiotic treatment dental bacteria, bacterial invasion, bone regeneration: anabolic agents , effectiveness of propolis , herbal approaches, modulation and treatment of periodontal disease, surgeries , new inventions , current developments in therapeutic periodontal assessment and periodontal therapy techniques for Periodontal disorders.

**Key Words:** Periodontal disease/Periodontitis, Biofilm, Dental plaque, Antibiotic resistance, Propolis, Herbal drugs.

### INTRODUCTION

The growth of plaque on the tooth, also known as oral bacteria, has been linked with periodontitis, a long-term complex autoimmune condition that results in the gradual degradation of the connective tissues supporting the tooth structure, especially the ligaments between the teeth and alveolar bone<sup>1,2</sup>. Periodontal illness is one of the most significant persistent infections in people, infecting as many as ninety percent of people around the world<sup>2,3</sup>. The periodontium is being impacted by this pathologic process. The American Academy of

**Address for Correspondence:** Jyoti Talageri, Department of Pharmacology, Maratha Mandal college of Pharmacy, Rajiv Gandhi University of health sciences, Karnataka, Bengaluru 4th block, Jayanagar, Bengaluru – 560041.; **E-Mail:** jyotitalageri@gmail.com.

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Periodontology (AAP) and the European Federation of Periodontology (EFP) use the following criteria to define periodontal illnesses and ailments: Periodontitis and other illnesses affecting the periodontium; gum infections and problems; periodontal health<sup>4,5</sup>. Periodontal diseases are polymicrobial, complicated diseases in which several host characteristics contribute to individual susceptibility to infection. The relationship between periodontal bacteria and their host is typically benign, but when a certain type of bacterium overgrows in the subgingival areas, it can cause periodontal swelling along with damage, including separation and loss of bones<sup>6</sup>. The main contributory factor of gingivitis is dental infections caused by bacteria<sup>7</sup>. Enamel debris, a film of microbes composed of a diverse bacteria population that accumulates on tooth surfaces can trigger an allergic reaction in periodontal cells. Symptoms of periodontal inflammation may include bleeding, swelling, and pain<sup>8</sup>. The disease occurs by complicated fluid relationships between specific microbes, inflammatory responses of the host's immune system, and environmental factors like tobacco use. Periodontitis is characterized by oral irritation, dental attachment displacement, radiological signs of alveoli loss of bone, deeper probing locations, movement, hemorrhage after probing, and histological migrations<sup>9</sup>. The most usual kinds of periodontal disease are gingivitis and periodontitis. These illnesses are caused by a set of dental bacteria that may generate microfilms on the enamel of teeth and within a dental pocket, triggering an inflammatory response in the host. Dental biofilm production produces gingivitis, which is clinically defined by inflammation, irritation, and mucosal hemorrhage<sup>10</sup>. Gingivitis sufferers typically have no damage to their alveolar bone or periodontal ligaments<sup>11</sup>. Periodontitis is described as the disintegration in the the alveolar enamel and oral tendons. Periodontitis symptoms include a gingival pocket, which promotes bacterial growth<sup>12</sup>. *Porphyromonasgingivalis*, *Tannerella forsythia*, and *Treponema denticola*, ect these are primary oral pathogens responsible for periodontal disease initiation and progression. The microorganisms were referred to the red complex is found in pockets in the gums where considerable periodontal tissue damage is observed<sup>13</sup>. *Fusobacterium nucleatum*, *Aggregatibacter actin omycetemcomitans*, and *Prevotella intermedia* are other periodontitis-associated bacteria. In addition to pathogenic microorganisms, particular to the host and contextual hazards affect illness progression<sup>14</sup>.

The most widely used clinical strategy in periodontal disease treatment has been the manual elimination of microfilms as well as plaque by scaling<sup>15</sup>. Enhanced brushing and flossing and elevated scaling can help with dental biofilm-induced gingivitis, but more severe periodontal disease requires surgical intervention. Antibacterial medications such as chlorhexidine and general antibiotics are sometimes used in conjunction with oral surgery for periodontal diseases. Among the most often used systemic antibiotics are extended-release doxycycline, metronidazole, and amoxicillin. Antibiotics are commonly given to patients as a prophylactic measure after extensive periodontal treatment. Nonetheless, the current trend of rising resistant microbes in human germs has coincided with a rise in antibiotic resistance in patients with periodontal disease in recent years<sup>16</sup>. These microbes are less vulnerable to medication because of the unique dental microenvironment and creation of biofilm. Periodontal problems necessitate novel curative strategies<sup>17</sup>. Various novel clinical and protective gingivitis remedies have emerged in the past few decades in order to gain a better understanding about microbial etiology, the microbiome of people, and host-microbe interactions. Anti-virulence therapy minimizes bacteria in the mouth by suppressing their viral transmission, making it a viable alternative to antibiotic treatment<sup>18</sup>. Immunoregulation based on phytochemicals along with microbiome-based strategies, like replacing the oral microbiota, hold promise for novel advancements in the management and avoidance of periodontitis<sup>19</sup>.

## **TREATMENTSOF PERIODONTAL DISEASE:**

### **1. BASIC SOURCE ASSOCIATED TREATMENT**

#### **HOME CARE REVIEW**

Adequate residence upkeep plays an essential role for long-term dentition retention, periodontal therapy success, and the avoidance of periodontal disease. Physicians should inform their patients of the value of properly cleaning their teeth at home, especially before beginning active periodontal therapy. Throughout the first and later stages of periodontal therapy, it is crucial to emphasize the value of providing proper home care<sup>20</sup>.

#### **ROOT PLANNING AND SCALING**

Cleaning and root planning should be performed in areas where periodontal drilling depths of 5 millimeters / greater have been achieved after establishing adequate home care or biofilm management. Treatment for active carious lesions, extraction of teeth that are hopeless, and correction of local contributory variables should all be provided concurrently with this phase of care. To enhance patient comfort during cleaning and root planning, an adequate regional pain reliever is needed administered prior to the treatment beginning. Manual instruments can

be used in combination with machines like piezo or supersonic scaling devices. Curettes might be less successful than automated equipment in eliminating subgingival biofilm and calculus in difficult-to-access places<sup>20</sup>.

## 2. ANTIBIOTICS DRUGS .

Drug resistance in periodontal microorganisms and the use of antibiotics infections of the oral cavity are treated with antibiotics<sup>19</sup>.

**Table no.1: List of the common antibiotics**

Sr.no	Drugs
1.	Doxycycline
2	Metronidazole
3.	Minocycline hydrochloride
4.	Clarithromycin
5.	Moxifloxacin
6.	hydroxyapatite and Ofoxacin
7.	Azithromycin

## 3. BACTERIAL INVASION: QUORUM SENSING AND QUENCHING:

The main adverse impact of treating periodontal disease with antibiotics is antibiotic resistance. Antibiotic-resistant periodontal bacteria can be selectively increased by overusing antibiotics. Antibiotics have so infrequently been used as an additional treatment in combination with surgical treatments such tooth cleaning and root planning to treat periodontal infections. Thankfully, new targets for reducing the pathogenicity of bacteria have been identified. Through the secretion of chemical signaling molecules known as autoinducers, microorganisms are able to monitor and adjust their population density. This is referred to as "quorum sensing (QS)," which is the capacity to adjust gene expression regulation in response to changes in population density. Because bacterial communication both inside and between cells is essential for the production of biofilms, blocking this communication is one way to regulate the expression of virulence factors and the creation of biofilms. Quorum quenching involves the procedure of inhibiting QS by the enzymatic hydrolysis of autoinducer. Gram-positive microbes use peptides as self-inducers whereas gram-negative microbes use N-acyl homoserine lactone (AHL). Thus, it is anticipated that quorum sensing inhibitors (QSIs), those are mainly generated spontaneously via algae, plants, fungi, and other organisms, are appropriate options for producing this quenching effect. Even though QSIs remain in the experimental phase, researchers believe they will open the way for the creation of new drugs for managing chronic gum disease. There is definitely reason for hope because some pre-clinical research has already shown that QSIs can effectively prevent the production of plaque biofilms and manage periodontal disease<sup>21</sup>.

## 4. BONE REGENERATION: ANABOLIC AGENTS

### i. TERIPARATIDE (FORTEO®):

Teriparatide (FORTEO®), produced from the effective component of the parathyroid hormone (PTH), was introduced as the Food and Drug Administration initial stimulating medicine approved for the treatment of osteoporosis. Teriparatide is being studied by periodontists as a potential treatment for alveolar bone regeneration due to its role in WNT/ $\beta$ -catenin signaling, which promotes bone production and inhibits sclerostin, a WNT-LRP5/6 inhibitor. Cyclic Adenosine Monophosphate, Protein Kinase, and Protein Kinase-1 are the components of a signaling cascade that is triggered by teriparatide. Teriparatide has the potential to be used as a therapeutic target for alveolar bone abnormalities, according to several preclinical investigations. Furthermore, considerable bone production was successfully achieved in clinical investigations when teriparatide was administered in a systematic manner for the purpose of regeneration of periodontal tissue. In a clinical study, a daily subcutaneous injection of 20 $\mu$ g of teriparatide for six weeks resulted in a 22% rise in clinical attachment level and a 33% reduction in periodontitis drilling depth in the osseous defect. Another study found that a 28-day intermittent dose of teriparatide increased the osseointegration of a titanium implant. Serum sclerostin antibodies are among the new prospective treatments that could provide similar benefits without the nuisance of regular injectable or the possibility of bone tumors, even if clinical side effects of teriparatide have

been noted. If new techniques to mucosal or regional administration of drugs are identified, teriparatide may be introduced to existing protocols for treating periodontal disease and dental implants<sup>21</sup>.

**ii. SCLEROSTIN ANTIBODY:** The WNT/ $\beta$ -catenin signaling system is crucial for osteoblast development and formation of bones, ranking second only to bone morphogenetic proteins. The agonist and antagonist that control WNT signaling are also responsible for other signaling processes. With its primary expression in osteocytes, the *SOST* gene-encoded protein sclerostin inhibits WNT signaling to have an anti-anabolic effect. Before, sclerostin was thought to be a BMP antagonist. Nevertheless, it was later discovered that sclerostin bound to the WNT co-receptor, a lipoprotein with a low-density receptor-related protein 5/6 (LRP5/6), preventing the WNT signaling cascade from occurring. Mutations in LRP5 reduced sclerostin binding, and the absence of sclerostin resulted in excessive bone mass (sclerosteosis). These results attracted a great deal of attention from the academic and commercial communities, where scientists have been studying the function of WNT signaling in bones for the past ten years using several genetic studies on people and mice. All of these studies confirm the significance of this route in bone biology and disease. Based upon these results, a substance called an antibody (Scl-Ab) continues to be intensively studied as a potential bone-anabolic therapy for osteoporosis, with numerous clinical and preclinical studies demonstrating its benefits on bone formation. Drugs that target the balance of osteoblasts and osteoclasts during bone remodeling, a common mechanism found in both alveolar and skeleton bone, might prove effective treatments for periodontal disease<sup>21</sup>.

## 5. PROPOLI'S ABILITY TO TREAT PERIODONTITIS

Natural products are increasingly being used to treat many illnesses, either as standalone treatments or as adjuvants to existing medications. Bees naturally create a material called propolis, which has shown promise in the treatment of periodontal disease. This meta-analyses and systematic reviews collects proof of propolis' usefulness in treating this sort of disease and it is safe to use<sup>22</sup>.

## 6. TREATMENT OF PERIODONTAL DISEASE – A HERBAL APPROACH<sup>23, 24</sup>

Numerous phytochemicals with pharmacological activity have been found to be beneficial in the management, prevention, and treatment of periodontal disorders. They could be alkaloids, flavanoids, terpenoids, tannins, etc. It has been shown that they have antimicrobial properties that are very beneficial for periodontal disorders. The safety and effectiveness of these herbal medicines are being evaluated through early-stage clinical research. In the future, it is anticipated that these herbal therapies will be widely used. Herbal treatments have a high benefit to low risk ratio, giving them an advantage over traditional antibiotic treatments, which are limited by their poor benefit to high danger ratio. Herbal and Ayurvedic medications have gained international attention throughout the past ten years, with both financial and medical consequences. Herbal excipients play a significant part in pharmaceutical formulation since they are safe and suitable.

**Table no. 2: List of Herbal drugs, family and common name**

Sr.no	Scientific Name	Family	Common names
1	<i>Punica granatum</i>	Lythraceae	Pomegranate, Dellma
2	<i>Azadirachata indica</i>	Meliaceae	Neem
3	<i>Ocimum sanctum</i>	Lamiaceae	Tulsi
4	<i>Acaciacatechu</i>	Fabaceae	Black catechu, catechu
5	<i>Glycyrrhiza glabra</i>	Fabaceae	Licorice and sweet wood
6	<i>Ficus religiosa</i>	Moraceae	Peepal tree
7	<i>Aloe barbadensis</i> Miller	Asphodelaceae (Liliaceae)	Aloevera
8	<i>Trifolium pretense</i>	Fabaceae	Red clover
9	<i>Medicago sativa</i>	Fabaceae	Alfalfa
10	<i>Mangifera indica</i>	Anacardiaceae	Mango
11	<i>Pongamia pinnata</i>	Fabaceae	Indian beech tree, Honge tree
12	<i>Cocos nucifera</i>	Arecaceae	Coconut
13	<i>Curcuma longa</i>	Zingiberaceae	Turmeric
14	<i>Psidium guajava</i>	Myrtaceae	Guava
15	<i>Citrus medica</i>	Rutaceae	Citron
16	<i>Ocimum Moringa oleifera</i>	Moringaceae	Drumstik

## **7. MODULATION AND TREATMENT OF PERIODONTAL DISEASE**

Adult tooth loss is primarily caused by periodontitis, the sixth most common illness worldwide. Now that the focus of periodontitis etiology is on the inflammatory/immune response, it is imperative to assess host modulatory drugs. Antirheumatic medications, both biological and synthetic, that regulate inflammatory processes are essential for treating inflammatory illnesses. Recent prospective cohort studies show that artificial antirheumatic medications with disease-modifying properties enhance periodontal clinical indicators after nonsurgical periodontal therapy in people with rheumatoid arthritis. Clinical investigations on COVID-19 pneumonia revealed that treatment with recombinant humanized monoclonal antibodies against CD20 (rituximab) and IL-6 receptor (tocilizumab), the latter of which is also used to treat periodontal inflammation, improved periodontal health. Investigation on the effects of TNF- $\alpha$  inhibitors on individuals suffering from periodontitis has produced mixed findings. Probiotics and nutritional supplements like n-3 fatty acids may have anti-inflammatory therapeutic benefits when used in conjunction with periodontal care, according to recent research<sup>25</sup>.

## **8. SURGERIES OF PERIODONTAL DISEASE:**

### **i. MINIMAL SURGICAL INCISION TREATMENT**

Minimally invasive procedures Treatment should start by enhancing the prospects of any existing dentition with nonsurgical treatment and adjuvant therapies, when required, before transitioning to surgical therapy if this method fails. Harrel proposed a surgical procedure for the repair of periodontal abnormalities that used short incisions and minimum flap reflection back in 1998. The outcomes for this method had been equivalent to those for traditional surgical procedures using greater flaps, with the additional advantages of less discomfort following the procedure, faster healing, preservation of soft tissue elevation, and acceptance among patients<sup>26</sup>.

### **ii. SURGERY**

As an essential component of traditional periodontal surgical therapy, osseous resurfacesurgery represents a very reliable procedure that aims to reduce pockets by creating a more physiological contour of the bone. Over the past few decades, ORS has been the subject of numerous short- and long-term studies, but only few clinical investigations have been concentrating on this issue over the past three years. It has recently been reported on a comparative analysis of the early inflammatory reactions after ORS using diamond burs versus piezosurgery. The clinical outcomes for all treatment groups were comparable, however the use of piezosurgery resulted in a reduction in the expression of gene IL-1 beta, a crucial proinflammatory cytokine, suggesting a less severe inflammatory response when compared to diamond bursts. Another benefit of piezosurgery that was mentioned in a split mouth report was that patients perceived a somewhat better tolerance to the procedure than they did to traditional rotary devices when it came to pain, bleeding, edema, and chewable discomfort<sup>27</sup>.

### **iii. GUIDED TISSUE REGENERATION**

Periodontal regeneration is the process by which damaged tissues regain their original structure and functionality. The goal of GTR is to use differential tissue responses to regenerate missing periodontal tissues. Many studies have been conducted on GTR processes. 52 randomised controlled studies with follow-up periods ranging from 0.5 to 10 years were included in the latest meta-analysis examined the extended efficacy of various treatments. The three fundamental objectives of this method include wound stability, wound healing, epithelial exclusion. In order to achieve these goals, soft tissue management is crucial. A new tunnel-like surgical method that retains the entire papilla has been shown to be effective for treating a deep and wide intrabony defect<sup>27</sup>.

## **10. NEW INVENTIONS IN PERIODONTAL TREATMENT**

Three of these new concepts are undergoing investigation; they appear to have great potential.

### **i. YAMA+ NATURAL TOOTHPASTE**

This toothpaste is called YAMA+ Natural, and it is made of 70% Dead Sea water and 30% anti-inflammatory essential oils. Gum disease can cure thanks to the long-standing benefits of salt. Clinical trials are being conducted for the new product<sup>28</sup>.

## **ii. AGED GARLIC EXTRACT**

This extract produced in Japan by the Wakunaga Company. Garlic has been utilized medicinally since 3000 B.C. and is the raw material needed to make AGE. Known by some as the "Miraculous Herb," garlic was utilized by the Soviets to prevent illnesses during World War II and as a stand-in for antibiotics when they were unavailable. The long-term extraction of fresh garlic produces AGE, an odorless substance that is extremely bioavailable and has biological activity in both humans and animals. According to a scientific experiment that was published in 2018, taking AGE on a daily basis improved oral health by lowering gingival bleeding and inflammation when compared to a placebo control group. After a four-month trial, the AGE group showed considerably superior results than the control (placebo) group<sup>28</sup>.

## **iii. OZONE THERAPY**

An alternative medical practice called ozone therapy promises to raise the body's oxygen content by introducing ozone. Natural disinfection ozonated water is compatible with the tissue of the mouth. Ozonated water kills dangerous germs and reduces irritation. The Pure Care dental irrigator is a unique approach that uses common water, a proprietary capsule, and a simple process to produce irrigatable Ozone. This product was just released on the market<sup>28</sup>.

## **10. RECENT DEVELOPMENTS IN THERAPEUTIC PERIODONTITIS ASSESSMENT AND TREATMENT METHODS**

### **i. PHOTODYNAMIC TREATMENT**

This works upon the assumption that the photosensitizer sticks onto the target area that gets triggered by a suitable wavelength of light when oxygen is present. This produces singlet oxygen and free radicals, both of which are harmful to certain types of cells and microbes. Apart from root planning and scaling, photodynamic therapy can be employed to improve microbiological and clinical characteristics<sup>29</sup>.

### **ii. LASERS**

Since the first laser was launched in 1960, dental researchers have been researching its potential. The Nd:YAG laser was successfully developed in 1990, specifically for utilization in dentistry facilities, as well as additional laser varieties quickly followed after FDA permission. Er:YAG laser-assisted dental treatment demonstrated potential in significantly repairing mild-to-moderate pockets in the gums without the need for surgery. It is marketed under the brand name Waterlase<sup>29</sup>.

### **iii. PERIODONTAL TRAYS**

This involves combining traditional mechanical techniques with chemical non-invasive therapy to assist particular patients in controlling the growth of biofilm in periodontal pockets. One such technique is Hydrogen peroxide gel applied topically to reduce bleeding and deeper pockets<sup>29</sup>.

### **iv. NANOTECHNOLOGY**

Though research in dental care remains at its early stages its promise has grabbed the medical world by storm. It won't be long until the condition is treated with it to the fullest extent of its efficacy. The germ responsible for the illness can be killed using nanorobots programmed with area-specific information, without harming commensal oral microflora that helps to preserve oral cavity health<sup>29</sup>.

## **DISCUSSION**

Periodontal disorders are pathological problems caused by infection or inflammation of the tissue that provides support for the teeth. Scaling and root planing, as well as an overview of home care, are the primary components of early non-surgical treatment for periodontics. The regaining of equilibrium in the microbes in the mouth as well as their compatible harmony with the host periodontal ligaments has become the fundamental objective of dentistry in the past few years, due to a greater awareness of the cause of gingivitis, which involves the immune system response of the host as well as the significance of the microbiome of humans. Alternative strategies for antibiotic therapy are needed in order to eradicate both beneficial and harmful bacteria indiscriminately. In several instances, proximal infection by bacteria and host-mediated immune reactions result in considerable oral loss of bones. Thus, new techniques are required in the treatment. The use of FDA-approved stimulant medications, such as teriparatide and sclerostin antibody treatments, and quorum quenching with quorum sensing inhibitors are discussed. Natural products have recently acquired popularity as treatments or adjuvants for other medications in the treatment of a variety of illnesses. Bees create propolis, a natural material that has been shown to be effective treatment. The toothpaste YAMA + Natural, aged garlic extract, and ozone therapy are becoming increasingly important in treatment and care. Herbal and Ayurvedic pharmaceuticals have grown

in importance around the world in recent years, with both therapeutic and commercial repercussions. Herbal excipients are nontoxic and compatible, and they serve an important role in pharmaceutical formulation. Since the beginning, herbal treatments have been used extensively around the world. Both doctors and patients are aware of the higher therapeutic benefit of these remedies due to their lower adverse effect rates compared to modern drugs. The inflammatory/immune response in the pathogenesis of periodontal disease is now the focus of investigation. The mainstay of treatment for inflammatory illnesses is the use of conventional and natural antirheumatic medications that modify disease. According to recent prospective cohort studies, patients with rheumatoid arthritis who received nonsurgical periodontal treatment saw improvements in periodontal clinical parameters after taking synthetic disease-modifying antirheumatic medications. Photodynamic therapy, lasers, periodontal trays, and nanotechnology are Current developments in clinical periodontal diagnostic and treatment protocols are reviewed here, along with information on surgical therapies for periodontitis.

## CONCLUSION

Periodontitis are clinical conditions caused by pathogens and inflammation of the periodontics, particularly the soft tissue that protects and supports the teeth. Periodontitis management and care require precise evaluation, eradication of triggers, and decreases in variable hazards. The mentioned treatments helpful in the treatment of Periodontal diseases.

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