

# Recent advances in periodontics

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## **Abstract:**

*Curiosity is the mother of invention; the more curious work more to develop and evolve giving rise to new science and technology. Many modifications have occurred in recent times in the field of Periodontology. These changes are opening a new dimensions in understanding the disease and in its treatment. In this article, we are trying to a few changes that have been introduced in the field of Periodontology in the last few decade<sup>1</sup>.*

**Keywords:** recent advances,periodontology,modifications

## **INTRODUCTION:**

Periodontal disease has been the biggest problem in our society since ages, its incidence is increasing these days because of the changes in eating habits and oral hygiene practices in the population. Earlier the diagnosis was made using probes and clinical signs of the disease along with radiographs. Nowadays there are various advancements introduced in the probing system which could help in identifying the exact measurements of pocket depth and clinical attachment loss. In accordance with the advancement in the probing system, there are various radiographic techniques developed which provide the three-dimensional view of the defect present in periodontal disease which helps in better treatment planning and hence treatment of the disease. We could now identify the individual susceptible to the disease way before the disease expresses itself and could also vaccinate the individual for the same. However, the gold standard for treating periodontal disease has been scaling and root planing but since last few decades newer methods in adjunct with scaling and root planing has been introduced which are not just eliminating the disease but also providing regeneration of the lost periodontal tissue. A few of the advances introduced in diagnosis and treatment of periodontal disease are enumerated under following headings.

1. The newer generation of probing systems
2. Nanotechnology in treatment of periodontal disease
3. Newer drugs developed for treating periodontal disease.
4. Ozone therapy in periodontology

## **DISCUSSION:**

### **a. The newer generation of probing system**

There are five generations of the probe that has been introduced in the field of Periodontology. The first generation includes the conventional probe like William's probe which was introduced by Charles H.M. Williams in 1936. These have a thin, blunt tip at the end of diameter 1 mm and length of 13 mm and markings 1, 2, 3, 5, 7, 8, 9, 10 mm. Then was introduced the second generation probe which was pressure sensitive by Hunter in 1994. These probes have a disposable hemispheric tip of 0.5mm diameter with a visual guide used sliding scale and two indicator lines that meet at a specified pressure. van der Velden and de Vies introduced a pressure sensing probe and with a cylinder and piston attached to the air pressure system.

In 1980 Polson introduced an electronic pressure sensitive probe which allowed for controlled insertion pressure. Then came the third generation probes to answer the limitations of the second generation probes. Foster-Miller probe is the standard probe for this generation introduced by Jeffcoat et al. in 1986 with controlled probing pressure and automated detection of the cement enamel junction. It has the following components a pneumatic cylinder, linear variable differential transducer (LVDT), force transducer, accelerator, and the probe tip. This probe can automatically detect the position of the cemento-enamel junction with controlled acceleration and pressure, the abrupt pressure changes are seen only when the tip of the probe reaches the cemento-enamel junction and base of the pocket<sup>1</sup>.

#### **b. Nanotechnology in treatment of periodontal disease**

The fourth generation probe is still under construction this probe aims at recording the sequential probe position with gingival sulcus to provide a 3D image of the defect site. Then is the fifth generation probe these probes are designed to provide a 3D image and are being noninvasive. The Ultra Sonographic probe uses the ultrasonic wave to detect, image and map the upper boundary of the periodontal ligament to mark the periodontal disease. There are further research going on to provide even better tool for periodontal disease diagnosis this includes Optical Coherence Tomography (OCT) introduced by Huang et al in 1991 works on principle of coherence near infrared region.

It gives real-time 3D tomographic image with resolution of 5-15 $\mu$ m and penetration depth of 1-2mm. Mota et al. used two OCT systems with 930 and 1325nm wavelength operating in Fourier domain to do the structural analysis of periodontal tissue in jaws of porcine and concluded that the operating system with 1325nm wavelength had better performance than 930nm. Fernandes et al. used OCT technology to measure gingival sulcus depth of anterior teeth at three sites (total 445 sites) in healthy individuals and compared it with North Carolina manual probe (UNC-15) and Florida automated probe.

Other technology like Endoscopic capillaroscopy that images microcirculation of periodontal pocket. The root of the system is made up of a fiber-optic image probe of 950  $\mu$ m that is inserted in the gingival sulcus or periodontal pocket. A 520 nm wavelength green light is used for illumination that is absorbed by both oxygenated and deoxygenated blood. Thus, blood vessels with red blood cells will appear dark against the green background. From this study the Authors concluded that the combination of capillaroscopy and optical fiber technology could produce high-resolution imaging of the periodontal pocket microcirculation. Another technology is the Photoacoustic imaging.

Photoacoustic (PA) imaging is a combination of the high contrast of optical imaging with the high resolution of ultrasound imaging. This imaging technique is based on the PA effect, first appreciated by Alexander G Bell in 1880. Then to these artificial pockets were added food-grade cuttlefish ink as a contrast medium and a comparison was made between PA pocket depth measurement and gold standard periodontal probing method, results showed that PA imaging technique could visualize the periodontal pocket with 0.01 mm precision.

Hence PA imaging technique can be used for periodontal pocket imaging and measurement as a diagnostic tool with the added advantage of non-invasive nature of modality. Diamond probe is another technology with additional benefit of measuring volatile sulfur content. It is plastic instrument with black bands for measurement of pockets apart from that it also measures the volatile sulfur content within the sulcus thus predicting the disease site for the clinician<sup>2</sup>.

#### **c. Newer drugs for treatment of periodontal disease**

The use of newer drugs to resolve inflammation in periodontal tissue like Resolvin. This drug has been used in pre-clinical models for treatment of asthma, rheumatoid arthritis, inflammatory bowel disease as it lowers the recruitment of neutrophils at the site of inflammation and also reduces the number of cytokines and reactive oxygen species being produced hence helps in reducing the

inflammation. Other than this, various other new drugs like TNF- $\alpha$  inhibitors such as Adalimumab, Golimumab; anti-cytokine agent like Anakinra, AMG714, Tocilizumab; and RANK/RANKL inhibitor like Denosumab.

These drugs are under study however their efficacy is being tested over experimentally induced periodontitis in the animal model. A new antibiotic study by Reed et al. named amixicile, a novel inhibitor of pyruvate ferredoxin oxidoreductase. A minimal inhibitory concentration ranging from 0.5–1.5  $\mu\text{g}/\text{ml}$  inhibited growth and other processes central to virulence in the in-vitro study<sup>3</sup>.

#### **D. ozone therapy**

In 1839, Christian Friedrich Schonbein, first noticed a pungent gas with an electric smell. According to the Greek language, he called it ozone from the Greek word ozein (odorant). Oxygen/ozone therapy has a long history of research with humans along with clinical application. In 1856, just 16 years after its discovery, ozone was started being used in health care setting to disinfect operating rooms and in sterilizing surgical instruments. Its first medical application dates back to 1870 when Dr. C. Lender purified blood in test tubes. By 1929, more than 114 diseases were listed to be treated with oxygen/ozone therapy<sup>4</sup>. In 1930, a German dentist, Dr. E.A. Fisch, used ozonated water as a disinfectant on a regular basis in his dental practice in Zurich, Switzerland, and published numerous papers on the subject. The first ozone generator for medical use was developed by German physicians named Joachim Hansler and Hans Wolff. Ozone has been used for following purposes:

1. Elimination of pathogens.
2. Restoration of proper oxygen metabolism.
3. Induction of a friendly ecologic environment.
4. Increased circulation.
5. Immune activation.
6. Simulation of the humoral anti-oxidant system.

Routes of administration are Gaseous ozone, Ozonated water, Ozonized oil. Huth et al. in 2006, in their study found out that the aqueous form of ozone, act as a potential antiseptic agent, and showed less cytotoxicity than gaseous ozone and established anti microbials (chlorhexidine digluconate [CHX]: 2%, 0.2%; sodium hypochlorite 5.25%, 2.25%; hydrogen peroxide-H<sub>2</sub>O<sub>2</sub> 3%) under most of the conditions. Kshitish and Laxman in 2010 performed a randomized, double-blind, split-mouth study on 16 patients suffering from generalized chronic periodontitis. The study period of 18 days was divided into two time intervals one at baseline-7 days followed by second interval of 7 days after a leeway of 4 days.

Sub gingival irrigation of each half of the mouth with either ozone or chlorhexidine was done at different time intervals. They observed a higher reduction in plaque index (12%), gingival index (29%), and bleeding index (26%) using ozone irrigation as compared to chlorhexidine Huth, et al. in 2011 compared the effectiveness of ozone with that of the of antiseptic CHX, against periodontal microorganisms. There were no significant differences observed in the effectiveness of aqueous ozone (20  $\mu\text{g}/\text{ml}$  [-1]) or gaseous ozone ( $\geq 4$  g [-3]) compared with 2% CHX but the effectiveness varied with 0.2% CHX which was less effective. Uraz et al. (2018) in their study used ozone as adjunctive therapy in chronic periodontitis patients. SRP treatment resulted in a significant reduction of Porphyromonas gingivalis (Pg) at 1st month and Tannerella forsythia (Tf) and Prevotella intermedia (Pi) at 3 months. SRP treatment resulted in significant reduction in the interleukin (IL)-8 levels at 1 month<sup>5,6</sup>.

Biofilms were formed on AISI 304 stainless steel coupons from a combination of three strains (one reference and two wild strains) of each microbial species and were subjected to three types of treatment for increasing times: (i) ozonized water (0.5 ppm) by immersion in static condition, (ii) ozonized water under flow conditions, and (iii) gaseous ozone at different concentrations (0.1–20

ppm)<sup>7</sup>. Treatment with aqueous ozone under static conditions resulted in a reduction of viability to 1.61–2.14 Log CFU/cm<sup>2</sup> after 20 min, while the reduction values were higher (3.26–5.23 Log CFU/cm<sup>2</sup>) for biofilms treated in dynamic Conditions.

*S. aureus* was the most sensitive species to aqueous ozone than to dynamic conditions. Gaseous ozone, at low concentrations (up to 0.2 ppm), resulted in inactivation of 2.01–2.46 Log CFU/cm<sup>2</sup> after 60 min, whereas at the highest concentrations a complete inactivation Wang et al. in their study examined the effects of ozone exposure on the production of collagen type-1 and inflammatory cytokines in primary human gingival fibroblasts (HGFs) in an in vitro condition using enzymelinked immunosorbent assays.

No cytotoxic effect of the ozone ointment was observed at concentration of 0.5ppm, where as cell viability was attenuated at the dose of 5ppm. When ozone ointment was used at the non-cytotoxic concentration of 0.5ppm, a significant enhancement in type 1 collagen production by HGFs was observed for 24 hours. Secretion of the pro-inflammatory cytokines interleukin (IL)-6 and IL-8 by HGFs treated with lipopolysaccharide (LPS) was decreased when ozone ointment was presented in the medium. Contraindications for ozone therapy Pregnancy, Autoimmune disorder, Hyperthyroidism, Anemia, Myasthenia gravis, Alcohol intoxication, CVD, Myocardial infarction, Ozone allergy, Hemorrhage<sup>4</sup>.

## CONCLUSION

As the progress is being made in the field of technology and science there is an advancement that is also observed in the understanding of the etiology and various the factor responsible for periodontal disease<sup>8,9</sup>. This broader understanding is helping in the development of various newer treatment modalities in the field of Periodontology. However, there is much yet to be discovered to remove all the present obstacles and to provide with even better technology and materials for the future<sup>10</sup>.

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