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Recent Updates on 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. How can Periodontology still untouched by these changes? From Neuman flap Microsurgery, from clinical detection of disease in the oral cavity to molecular basis of detection and so on. During that time, a large portion of the exploration was centeredon the microbiological parts of the periodontitis. It has been seen that microscopic organisms alone are not adequate for the inception of periodontal infections, despite the fact that they have a significant influence simultaneously. Host reaction, smoking, stress and other danger factors impact the presence of the infection, and the weakness to forceful types of periodontitis is hereditarily decided.

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.[1]These days there are various headways presented in the examining framework, which could help in recognizing the specific estimations of pocket profundity and clinical connection misfortune. As per the progression in the testing framework, there are different radiographic strategies created which give the three-dimensional perspective on the imperfection present in periodontal disease, which helps in better treatment arranging and consequently treatment of the infection.[2]

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. [3]We could now identify the individual susceptible to the disease way before the disease expresses itself and could 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,instead of just repair as was achieved by flap surgeries, for normal functioning of the masticatory apparatus. The various advances introduced in diagnosis and treatment of periodontal disease are enumerated under following headings.[4,5]

The various advances introduced in diagnosis and treatment of periodontal diseaseare enumerated under following headings.

1. Biomarkers for the diagnosis of the disease
2. Probiotics in the treatment of periodontal disease
3. Lasers in the treatment of periodontal disease
4. Microsurgery for periodontal treatment
5. Nanosurgery
6. Tissue engineering in treatment of periodontal disease

Since long periodontal disease detection is being carried out using periodontal probes and radiograph but now it can be detected even using biomarkers at an early stage before the disease has produced optimal destruction to the periodontium.

The term Bio marker was presented in 1950s. Different media are being utilized for obtaining biomarkers these media are pee, salivation, serum, gingival crevicular liquid. The different biomarkers can be ordered under after headings proteomic biomarkers, hereditary biomarkers, microbial biomarkers, and others biomarkers. Biomarkers

like basic phosphatase, Aminopeptidase, Lactoferrin, Translactoferin, IgM, MMP-13, MMP-8, MMP-9 are proteomic biomarker; IL-1 polymorphisms, IL- 10 polymorphisms, Tumor rot factor, Polymorphisms are hereditary biomarkers; Aggregatibacteractinomycetemcomitans, Campylobacter rectus, Mycoplasmas, Porphyromonasgingivalis, Prevotella intermedia, Peptostreptococcus are microbial biomarkers; and Calcium, Cortisol, Hydrogen sulfide, Methyl mercaptan, Pyridine are different biomarkers.Biosensors these are gadgets which identify and measure compound and natural responses by creating signals at the point when it interacts with the analyte.

These gadgets are currently being utilized to recognize biomarkers for periodontal also, peri-embed ailments. 16,17 In 2016 Mohseni et al. utilized Carboxymethyldextran hydrogel sensor chip with immobilized monoclonal MMP-9 antibodies to distinguish Grid metalloproteinases(MMP-9) to analyze interminable periodontal sickness. 18,19 In 2017 Ritzer et al. utilized Diagnostic biting gum in his investigation to recognize Matrix metallo-proteinases (MMP-1, MMP-8, MMP-9) for determination of peri-embed ailments. Every one of these creators recommended further clinical preliminaries for the use of biosensors in more extensive population.[7,-9]

Nowadays technologies like lab-on-a-chip (LOC) are being used as point-of-care testing device to detect various biomarkers for periodontal disease. LOC work on the principle of immunoassay for example, Christodoulides et al. developed a LOC platform that uses a microfluidic chip with a fluorescence-based optical system to quantify three salivary biomarkers (MMP-8, IL-1b, and C-reactive protein) for periodontitis diagnosis. The results were compared with the results obtained using standard ELISA testing. Comparison stated that LOC device can achieve a sensitivity of 20ng/ml for MMP-8 and 10pg/ml for IL-1b and C-reactive protein. Another immunoassay-based LOC device, called the integrated microfluidic platform for oraldiagnostics (IMPOD), was developed to detect various salivary proteins in a small sample volume (10 ml) but with high sensitivity. Recently, for rapid detection of periodontal pathogens a PCR chip has also been devised. The device consists of two components: a microfluidic cartridge containing all the PCR reagents and a component that is used to drive and control the working process.

The basic elements of the drive consist of a rotary PCR chip and a thermo cycling device which is formed by six fanshaped heating blocks, three for achieving denaturation, annealing, and elongation, and others three for rapidly changing the temperature inside the blocks with samples and PCR reagents are mixed in a chip during the detection process, which then rotates on the thermo circulator to conduct PCR. In every cycle, a fluorescence detector quantifies the fluorescence signal at 72℃ to detect the amplification. This device can measure different bacterial strains in clinical sample.[10-14]

Probiotics in the treatment of periodontitis

Elie Metchnikoff Ukrainian Nobel prize laureate at the beginning of 20th century discovered some beneficial bacteria that have a good effect on health and suggested that these bacteria can be used to reduce the number of harmful bacteria in human body. Probiotics can be defined as “Live microorganisms that once administered in adequate amounts confer a health advantage on the host”(Guarner et al., 2005).[15]

The instrument of activity for the Probiotics are as per the following-

1. It either go after space and total, hindering grip ofpathogenic microscopic organisms or hindering its development furthermore, different impacts on dental plaque environment,

2. or it seeks supplements and development factors by delivering antimicrobial mixes like acids accordingly restraining development of microbe,

3. or it improve have insusceptible reaction by expanding the creation of IgA and defensins, or it hinders the creation of favorable to provocative cytokines in this way impacting nearby and foundational resistant reaction. All these instrument goes about as foe against pathogenic microorganisms prompting decrease in tissue irritation and decimation. Zupancic et al. in their examination consolidated autochthonous microorganisms an expected probiotics into nanofibers for nearby treatment. They chose and confined the strain 25.2.M from the oral microbiota of sound Volunteers, distinguished as Bacillus sp. in light of 16S rRNA arrangement examinations.

This strain is nonpathogenic and produces an antimicrobial substance just as it can develop over the periodontal microbe Aggregatibacteractinomycetemcomitans in vitro, consequently making it a good probiotic competitor. The strain 25.2.M was effectively coordinated into the nanofibers as spores (107CFU/mg), the suitability of which were acceptable (max.change of 1 log unit) both during the electro turning and following a year of capacity. The created nanodeliveryframework for organization into periodontal pockets, offers a promising pay special mind to the restraint of periodontal microbes with the rebuilding of the sound oral microbiota. Golfre et al. in their examination utilized Lactobacillus reuteriProdentis as a probiotic to treat patients with periembedmucositis or periimplantitis who previously had periodontitis in mix with non careful mechanical treatment and discovered that there was noteworthy improvement in clinical boundaries both in mucositis and periimplantitisaround embed.[16]

Lasers in treatment of periodontal disease

The concept of LASER was first given by Albert Einstein. He was the first to describe the stimulated emission of light. Using his theory Maiman an American physicist developed laser with the help of ruby crystal in 1960. The laser was introduced in the field of dentistry by Myers andMyers on 3rd May 1990 after the pioneer work done with laser by Doctor Leon Goldman since 1963. Laser is being used for various purposes in the field of periodontology like in sulcular debridement, soft tissue ablation, curettage,de-epithelialization, incision, desensitization of exposed root surface, second stage implant surgery, osseous ablative surgery, soft tissue crown lengthening, and frenectomy. The use of Laser free running pulsed Nd: YAG for treatment of periodontal disease was proposed by Dr. Robert Gregg and Dr. Delwin McCarthy. The sulcular debridement by lasers also known as LANAP received its clearance for use as sulcular debridement tool in the year 2004 by FDA after all research-proven datwere analyzed. For this procedure a Periolase laser MVP-7 basically an Nd: YAG which operates at a wavelength of 1064 nm was developed. McCawley et al.

In their studycompared the Laser-Assisted New Attachment Procedure (LANAP) with ultrasonic root debridement alone for immediate post-treatment effects on putative bacterial pathogens in deep human periodontal pockets. For this 26 systemically-healthy adults with severe periodontitis were selected. LANAP surgery was performed using, pulsed Nd: YAG laser, with laser energy (4.0W, 150-µs pulse duration, 20-Hz) directed circumferentially around teeth parallel to root surfaces in a coronal-apical direction to probing depth. After ultrasonic root debridement and gingival flap advancement to the alveolar bone crest, a second laser pass (4.0 W, 650-µs pulse duration, 20-Hz) was similarly performed in an apical-coronal direction to thermally initiate a fibrin clot at the tooth-gingival flap junction. Subgingival biofilm specimens were collected before and immediately after completion of the treatments from 2 inflamed periodontal sites with ≥ 6 mm probing depths, and selected periodontal pathogens were identified using established anaerobic culture techniques. Results showed a negative culture for red and orange complexbacteria for the 17 patients out of 20 treated with LANAPwhere as it was only 1 for 6 treated with ultrasonic debridement. Another advancement in the laser dentistry is waterlaselaser its use was approved by FDA in the year 1998 for cutting of tooth structure.

It is basically an ErbiumChromium doped Yittrium-Selenium-Gallium-Garnet (Er, Cr: YSGG) laser which works on the principle of Hydrophotonics that uses the combination of laser energy and water to perform the various procedure in dentistry. This Waterlasework on a wavelength of 2.78µm. A dual wavelength soft tissue diode laser has been introduced by Ultra Dent Products, Inc. named Gemini810 +980 diode laser for soft tissue laser surgery it has been approved by FDA for usage in 20 dental procedures including crown lengthening. This system also possess illumination at the tip for surgical assistance. Another laser system SiroLaser Blue has been introduced that works at three wavelengths that is at 970, 660 and 445nm. This system has been newly introduced in United States in September 2018 and promoted by Dr. SmonSuppelt for its cutting efficiency at 445nm. This is manufactured by Dentsply Sirona. This system emits blue light at 445nm.[17-19]

Nanotechnology

A nanomaterial is an object with at any rate one measurement in the nanometer scale (around 1 to 100 nm). One billionth of a meter (10-9m) is one nanometer. US government characterized nanotechnology as "Nanotechnology is research and innovation improvement at the nuclear, sub-atomic or macromolecular level in the length size of around 1-100 nm go, to give an essential comprehension of wonders and materials at the nanoscale and to frame and use structures, gadgets and frameworks that have novel properties and capacities because of their little or potentially transitional size. " Nanotechnology has been utilized in the field of dentistry since mid 1970, the period of microfills.

From that point forward different nanomaterials were presented in the field dentistry counting periodontology for legitimate oral wellbeing support. Nanomaterials like Bioactive glass, carbon nanomaterials, Titanium nanotubes covered dental inserts, nanoceramics for bone recovery; nanobiomaterial being utilized for the planning of platforms for recovery of periodontium metallic nanoparticles as toothpaste and mouth flushes for control of oral biofilm and nanoparticles for neighbourhood drug conveyance, Nanorobots for oral absense of pain,drug conveyance and so forth. Examination is being done in the field of nanotechnology for delivering better and even adjusted items for periodontal recovery with the end of reactions and expanding the biocompatibility of the item.[20]

Microsurgery for periodontal treatment

Microsurgery is defined as the surgical procedure done under the microscope (as defined by Daniel in 1979) for better visualization so that less trauma is rendered to the tissue with better healing results. Magnification in the field of surgery was introduced by Carl Nylen, thus he is considered the father of microsurgery, he used microsurgery for correction of otosclerotic deafness. Apotheker and Jako were first to introduce microscope in the field of dentistry in the year 1978. The use ofmagnification in the field of Periodontology wasintroduced in the year 1992. Since then various enhancement in the magnifying power of the system used for microsurgery that is from loupes to surgical microscope has been made. Nowadays the various advancement made in video technology had made it possible to

visualize the operating field on the screen inthree dimensions thus excluding the need to actually lookinto the eyepiece of the microscope.The introduction of microsurgery was done to increasevisibility, minimize trauma and to enhance surgical results. In the field of Periodontology microsurgery is being used I the following procedures perio-aesthetic surgeries like root coverage procedure, papilla reconstruction, aesthetic implant surgery, periodontal flap surgery, alveolar ridge deficiencies management, sinus lift procedure etc.

MIS technique that is minimally invasive surgery is one of the outcomes of usage of magnification in periodontal surgery. The term MIS was given byHarrel and Rees in 1995. Tibbetts and Shanelec in 1994 used the microsurgical technique for periodontal soft tissue regeneration and augmentation. Cortellini and Tonetti in 2007 came with the concept of minimally invasive surgical technique and later introduced the concept of space provision for regeneration with the modified MIST 2009 (M-MIST). The procedure is done under magnification with microsurgical instruments. Loups or microscope is being used for the purpose with magnification ranging from 3.5-20. The main advantage of the procedure is less postoperative pain and better and faster healing.[4,7,9]

CONCLUSION

As the advancement is being made in the field of innovation what's more, science there is a progression that is additionally watched in the comprehension of the etiology and different the factor liable for periodontal ailment. This more extensive understanding is helping in the improvement of different more up to date treatment modalities in the field of Periodontology.

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