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President's message

Dear colleagues,

Warm regards to all from Kottayam.

Recently a 52 year old female was referred to me by an ENT surgeon, with the C/C of recurrent pain on the left side of the face and head since two years. She consulted many doctors including few dentists, one of them extracted her 24 but there was no change in her condition. No significant findings were seen, in and around her sinuses on any of her x-rays taken by different doctors.

O/E multiple periodontal pockets were found in both arches but hardly any inflammation was noted. No caries was detected on any teeth or any TOP. One year old OPG revealed moderate bone loss on upper arch and mild to moderate bone loss on lower.

Even though I reached a diagnosis as chronic adult type periodontitis, to rule out any other pathology,referred the patient for a CBCT of left side of maxilla. I was shocked to receive a report which says that there is no dental pathology that too printed in red colour. I contacted the Oral medicine radiology doctor who gave this report and asked him about the periodontal condition of the patient. He maintained his view that mild to moderate bone loss in the 50 plus old patients is normal. I tried to explain about the changes which occur in the bone during the various stages of periodontitis but he told me he will contact his association in this regard and will get back to me but so far didn't hear anything from that side.

I would have considered it as OK if this report was given by a MD radiologist, but if a dentist who studied perio during his under graduate level considering mild to moderate bone loss in both arches not as a pathology!! Then there is some basic mistake in our way of handling perio at the under graduate level. It's high time those in academics take the initiative to redress this fault.

Now imagine the condition of the practitioner who made the diagnosis and treatment plan. The lab report says there is no pathology at all, will it be possible to convince the patient with such a report. But in this case the patient was running from pillar to post for the last two years, so they were ready to take my advice for a full mouth Laser Assisted Periodontal Therapy. After the initial healing period she says there is improvement in her condition.

Our executive committee sanctioned my proposal to produce two videos to enhance the awareness among dental surgeons as well as the general public about perio. We invite suggestions from all of you in this regard. If you want to be a part of this project please contact me.

I would like to place on record my appreciation to our secretary Dr Jayan Jacob, our scientific committee chairman Dr Plato Palathingal for successfully conducting the webinar, and also to Dr Sameera G Nath for her untiring efforts to bring out this second issue of the journal.

Thank you.

Dr Sabu Kurian
President, SPIK

Secretary's Message

Dear SPIK members,

Happy to know that all fellow members are keeping fine amidst this unprecedented pandemic. Like all spheres of life, our association activities also remain constrained by the COVID situation. Yet, we could conduct a couple of activities in the digital mode.

In connection with the National Oral Hygiene Day, we organized two online events in association with IDA Malanadu and IDA Trivandrum branches. The former was a 'White Board design Competition' coordinated by Ekadhya Students Union of Indira Gandhi Institute of Dental Sciences, Kothamangalam while the latter event included Slogan Competition, Instagram Reel Making Competition, and Water Color Painting Competition. On behalf of SPIK, I thank the associations and institutions for joining hands with SPIK in spreading oral hygiene awareness.

SPIK conducted the online scientific event "Platelet Rich Fibrin: Clinical Applications and Technical Considerations" on September 30th, 2021, by Dr. Mihir Kulkarni, Faculty of SDM Dental College, Dharwad, with an attendance of over 200 participants. The session was ably moderated by Dr. Baiju R M, and was well appreciated for its scientific content. I gratefully acknowledge the efforts of our Scientific Convenor, Dr. Plato Palathingal in the realization of this event.

On a customary note, I should thank our Editor, Dr.Sameera for bringing out this journal. But her untiring and dedicated efforts in ensuring the uninterrupted publication of JSPIK are worthy of special mention. I once again request everyone to contribute to our scientific publication in the best possible way.

As our association is completing 15 years of existence, I wish to extend my heartfelt gratitude to all past and present office bearers and fellow SPIK members for the support and co-operation extended all through these years. Lets all hope to have normalcy restored in our world soon.

Dr. Jayan Jacob Mathew
Secretary, SPIK

INFORMATION TO AUTHORS

About the Journal

JSPIK accepts articles from dentists, dental specialists (any speciality) and students. The articles submitted must have relevance to the speciality of Periodontics. Authors are encouraged to submit research papers, interdisciplinary case reports, interesting case discussions, letters to editor review articles or short communications.

Manuscripts

Articles should be type written on one side of A4 size (21x28cm) white paper in double spacing with a sufficient margin. Use a clear and concise reporting style. SPIK reserves the right to edit, manuscript, to accommodate space and style requirements. A soft copy of the article also has to be send to the editor's email: **editorspik@gmail.com**

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- **Abstract:** An abstract of the article not exceeding 200 words should be included with abbreviated title for the page head use. Abstract should state the purpose of the study, investigations, basic procedures and the main findings. 4 key words of article should be mentioned below the abstract.
- **Tables:** Tables should be self explanatory, numbered in roman numbers, according to the order in the text and type on separate sheets of paper.
- **Illustrations:** Illustrations should be clearly numbered and legends should be typed on a separate sheet of paper, while each figure should be referred to the text(figure 1,2 etc.)
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Evaluation of Corah's Dental Anxiety Scale and Visual Analogue Scores (VAS) for patients undergoing Periodontal Therapy: A Pilot Study

Deepak Moses Ravindran[1], Sivaranjini Anantharaj[2], Balaji S.K[3], Muthukumar S[4]

ABSTRACT

Dental phobia, a phobic disorder, is a problem that affects a large number of individuals. Phobia is one of the foremost reasons in patients avoiding treatment and postponing visits to the dentist until acute symptoms arise. This questionnaire study using Dental Anxiety Scale (Corah's) pre – operatively and a Visual Analogue Scale (VAS) post - operatively will help the clinician understand the psyche of the patient and improve patient comfort in the operatory. The purpose of this study is to evaluate degree of anxiety prior to dental treatment and discomfort following minor periodontal therapy like gingivectomy, gingivoplasty, frenectomy, frenotomy, operculectomy, single tooth crown lengthening, depigmentation.

KEY WORDS: Dental phobia, dental anxiety scale, visual analogue scale

Introduction

Dental phobia, a phobic disorder, is a problem that affects a large number of individuals. Phobia generally is misinterpreted by most people including health care workers with other terms like Anxiety and Fear. Anxiety involves apprehension regarding a future situation. Fear usually occurs as a result of exposure to situations that are either real or imagined. A phobia is a form of fear that cannot be controlled voluntarily. Dental phobia is one of the foremost reasons in patients avoiding treatment and postponing visits to the dentist until acute symptoms arise. This questionnaire study using Dental Anxiety Scale (Corah's) pre – operatively and a Visual Analogue Scale (VAS) post - operatively will help the clinician understand the psyche of the patient and improve patient comfort in the operatory. Corah's Dental Anxiety Scale is a reliable tool used in Dental Clinics or in research projects for measuring anxiety prior to variety of periodontal therapy. Visual Analogue Scale (VAS) is often used in epidemiological and clinical research to measure the intensity and frequency of various symptoms, mostly pain or discomfort. VAS is a unidimensional measure of pain intensity which can be presented in a number of ways. For the present study VAS Score will be determined by a questionnaire which has a horizontal scale from "No Pain" to "Hurts the Worst". The purpose of this study is to evaluate degree of anxiety prior to dental treatment and discomfort following minor periodontal therapy like gingivectomy, gingivoplasty, frenectomy, frenotomy, operculectomy, single tooth crown lengthening, depigmentation.

Materials and methods

A questionnaire was handed out to willing participants of the study, who are undergoing Periodontal Therapy and are being treated in the Department of Periodontology, Faculty of Dental Sciences, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai. The proposal for the study was sent for Ethical approval and was approved by the Sri Ramachandra Institute of Higher Education and Research Institutional Ethical Committee. The Dental Anxiety Scale (Corah) questionnaire was issued to the patients when they were advised for periodontal therapy and the Visual Analogue Scale was issued immediately post operatively and when they reported for review after 2 weeks. Sample size for the study included 50 patients. Inclusion Criteria for the study were male and female

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patients, between 18 to 50 years of age, who have been advised conventional minor periodontal surgery for the first time. Exclusion Criteria included patients on long term NSAID's, nonopioid analgesics, muscle relaxants and those who had undergone minor periodontal or oral surgical procedures in the past. The duration of the study was from October 2019 to December 2019. All surgical procedures were carried out by single operator in the above mentioned 3-month period to rule out any operator bias. All 50 patients completed the study.

TABLE -1: Comparison of Visual Analogue Scale immediately after treatment and 2-week post-operative distributed based on gender of the participants.

VAS Score * Gender		Immediate			2week post OP		
		Sex		Total	Sex		Total
		F	M		F	M	
VAS Score	.0	1	0	1	2	1	3
	1.0	0	1	1	22	21	43
	4.0	2	0	2	2	2	4
	5.0	7	3	10	0	0	0
	6.0	5	8	13	0	0	0
	7.0	7	7	14	0	0	0
	8.0	2	1	3	0	0	0
	9.0	0	3	3	0	0	0
	10.0	2	1	3	0	0	0
Total		26	24	50	26	24	50

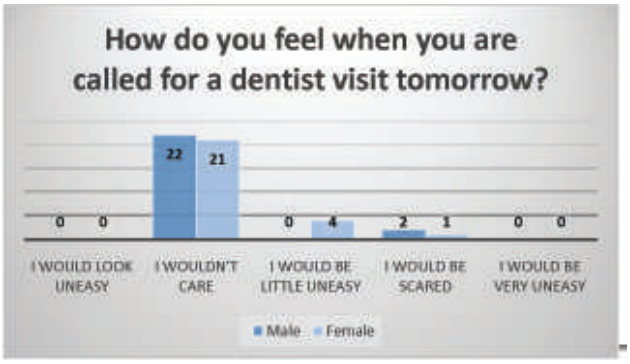

Figure 1: Response to question 1

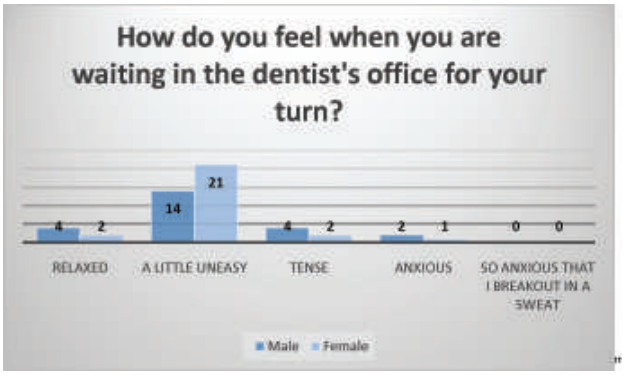

Figure 2: Response to question 2

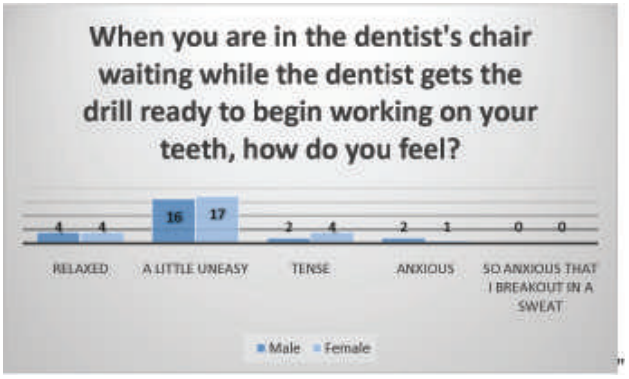

Figure 3: Response to question 3

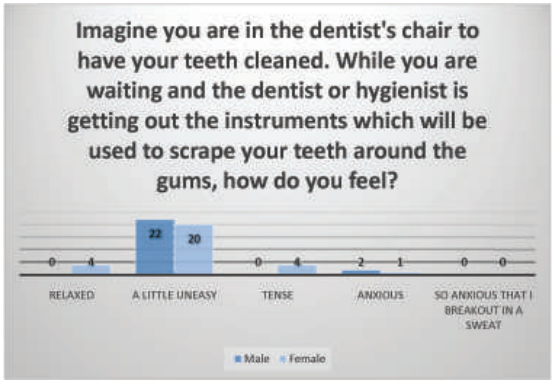

Figure 4 : Response to question 4

Statistical analysis

Chi square test was done to check relationships between gender and anxiety score. The results revealed that there was no association and p value (.752) and chi square value (.72) was insignificant. The insignificant score means there is no relationship between gender and anxiety score categories Descriptive distribution of participants based on Corah anxiety score categories and visual analogue scale was done.

Results

Visual Analogue Score (VAS)

The pain VAS is a unidimensional measure of pain intensity, which has been widely used in a diverse adult population to assess pain post operatively and also in patients with chronic pain conditions. In our study it was used immediately post operatively and after two weeks, when patients reported for suture removal / review.

The results of VAS scores immediately post operatively included 37 patients in the "Moderate Pain" category out of which 18 were male patients and 19 were female patients. 9 patients fell under the "Severe Pain category" out which 4 were female and 5 were

male patients. 4 patients rated the procedures as "No pain" to "It Pains a Little". It included 3 female patients and 1 male patient. All 50 patients had "No pain" to "It Pains a Little" during review / suture removal at two weeks. (Table 1)

Corahs Dental Anxiety Scale:

For the first question "If you had to go to the dentist tomorrow for a check-up, how would you feel about it?", 43 participants replied to option B - "I wouldn't care one way or the other". (Figure 1)

For the second question "When you are waiting in the dentist's office for your turn in the chair, how do you feel?" 35 participants replied to option B – "A little uneasy" (Figure 2)

For the third question "When you are in the dentist's chair waiting while the dentist gets the drill ready to begin working on your teeth, how do you feel?", 33 participants opted for option B - "A little uneasy" (Figure 3)

For the fourth question "Imagine you are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist or hygienist is getting out the instruments which will be used to scrape your teeth around the gums, how do you feel?", 42 participants replied to option B – "A little uneasy". (Figure 4)

Discussion

Dental fear has been suggested as a conditioned reaction to previous negative dental experiences and unpleasant dentist contacts[1]. Dental anxiety has been reported to lead to avoidance behaviour and cause delay in regular or necessary dental treatment and this also negatively affects dental health[2,3].

Anxiety score for the four questions was significantly higher in females according to a studies done previously[4,5]. However, in our study both male and females showed anxiety before periodontal procedures. An association between Corah's Dental Anxiety Scale (DAS) scores and decayed, missing, and filled surfaces (DMFS) status in young men with relatively low level of dental caries has been observed in a study by Cohen ME et al[6]. In a more recent study by Levin et al, patients with Aggressive Periodontitis patients were positively associated with higher levels of dental anxiety and worse oral hygiene related quality of life (OHRQOL)[7].

VAS is a measurement that tries to achieve a characteristic across a continuum of values and is generally used to gauge patient response to pain before, during or post medical treatment. In our study VAS scores were recorded immediately post minor periodontal therapy and during recall visit or suture removal two weeks postoperatively. Most patients showed "Moderate Pain" immediately post operatively and all 50 patients had "No pain" on recall visit or suture removal two weeks postoperatively. Most studies taking VAS scores showed patients having Discomfort during periodontal treatments, postoperative pain and postoperative dentin hypersensitivity were associated significantly with age, type of therapy and higher scores on Corah's Dental Anxiety Scale. This established a link between high VAS scores and patient anxiety.

Periodontal treatment is perceived to be painful and substantial number of patients experience anxious emotions before periodontal treatment. Therefore, the dentist should assess the pain responses during and after treatment and estimate the degree of pain according to the sex, age and type of therapy.

Conclusion

Dentist's/ Periodontist's need to be trained in identifying and managing patients with Dentophobia. Cognitive-behavioral therapy by mental health professionals, medications and hypnosis can help patients having severe phobia. Relaxation techniques can also be used to diminish fear. Deep breathing exercises, muscle relaxation, music and guided imagery can help a patient to relax while on the dentist's chair.

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Ozone Therapy-A Milestone in the Field of Dentistry: A Review

Anania Thottappilly[1], Sanjeev Raveendran[2], Shyamala Devi M.P[3]

ABSTRACT

Ozone due to its unique properties like analgesic, antihypoxic, detoxicating, immunostimulant, antimicrobial, biosynthetic and bioenergetic properties is used to treat various diseases by activation of the metabolism of carbohydrates, protein and lipids. It is found in the stratosphere and is used in dentistry for the treatment of incipient carious lesions, gingival and periodontal diseases. It is also found to be effective in curbing the resistant microbial root canal flora. This article is an attempt to summarize the various applications of ozone therapy in dentistry.

KEY WORDS: Ozone, caries, periodontal disease, antimicrobial, antihypoxic, biosynthetic, immunostimulating

Introduction

Ozone a colorless gas form of oxygen with chemical formula O_3, is highly effective in killing bacteria, virus, fungi and parasites at low concentration. It has been proposed as an alternative oral antiseptic in dentistry. There are many known action of ozone on human body such as immunostimulating, analgesic, antihypoxic, detoxicating and antimicrobial properties. This new notion has given rise to a number to a number of procedures and aims in eliminating only the infected and demineralized dental tissue and conserves and protects the tooth structure.[1]

It is the third most powerful oxidant, with a molecular weight of 41.98g/mol.[2] It has been used to purify water throughout the world for many years. Extensive research has been carried out over past 50 years into the use of ozonated fluids for infection control and wound management.[3]

The objective of this article is to provide a general review about the clinical applications of ozone therapy in the field of dentistry.

Chemistry

Ozone which consists of three oxygen atoms, is a thermodynamically highly unstable compound when compared to oxygen. Ozone is 1.6 fold more denser and 10 fold more soluble in water. It gives up nascent oxygen, which is used in medical field to kill bacteria, fungi, inactivate viruses and control hemorrhages.[4]

History

The German chemist, Christian Friedrich Schonbein regarded as the Father of ozone therapy (1840) first used the term OZONE (derived from the Greek word "ozein" which means odor) He subjected oxygen to electrical discharges and noted "the odor of electrical matter". Joachim Hansler (1857), a German physicist and physician, along with German physician, Hans Wolff, developed the first ozone generator for

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medical use. Dr. C. Lender (1870), for the first time applied O_3 into medical field. He purified blood in test tubes by using O_3. In 1893, Ousbaden. Holland became the first city to utilize a water treatment plant using ozone. In World War I and II it was used to treat wounded soldiers in the trenches. In early 20th century Food and Drug Act, revised its use and effect in the field of medicine. Dr. E.A. Fisch (1950) a German dentist, was the first dentist to use ozone on regular basis in his dental practice in Zurich, Switzerland and published numerous papers on its application in dentistry. Numerous researchers since that time have worked to elucidate the nature and actions of ozone. Mariniak and Delarive showed that it is an allotropic form of oxygen, and Mulliken and Dewar clarified its molecular structure.[5]

How ozone works?

Ozone works in the same manner as the human body. When infection occurs, white blood cells enter bacteria and create an oxidative burst. This reaction to the white blood cells causes a puncture and the wall of the targeted microbe, and the cell dies off. The several mechanism of actions of ozone are: anti-microbial, antiinflammatory, analgesic, immune stimulating, anti - hypoxic, detoxicating, bio-energetic and biosynthetic (activation of the metabolism of carbohydrates, proteins & lipids) actions.[6]

Figure 1: Formation of Ozone

Mechanism of action

Anti-microbial action

The anti-microbial effect of ozone is as a result of its action on cells by damaging its cytoplasmic membrane due to ozonolysis of dual bonds and also ozone-induced modification of intracellular contents because of secondary oxidants effects. This action is non-specific and selective to microbial cells; it does not damage human body cells because of their major antioxidative ability. Ozone is very efficient in antibiotics resistant strains. Its anti-microbial activity increases in liquid environment of the acidic pH. In viral infections the ozone action lies in the intolerance of infected cells to peroxides and change of activity of reverse transcriptase, which takes part in synthesis of viral proteins.

Immuno-stimulating action

Ozone influences cellular and humoral immune system. It stimulates proliferation of immunocompetent cells and synthesis of immunoglobulins. It also activates function of macrophages and increases

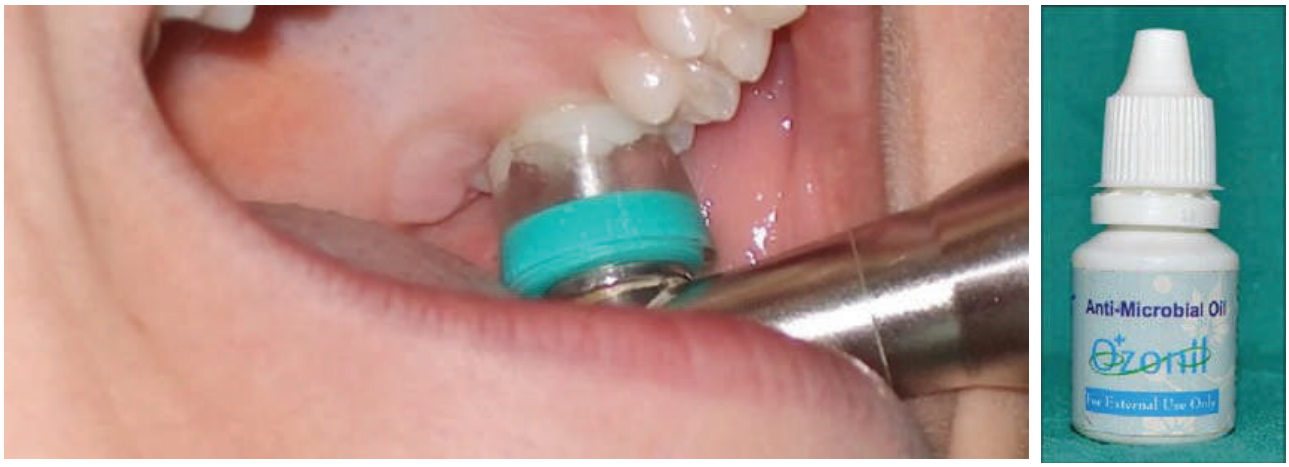

Fig 2 :(a) Gaseous ozone; (b) Ozonated oil

sensitivity of micro-organisms to phagocytosis. When administered at low concentrations, the organisms own resistance is mobilized, i.e. ozone (re) activates the immune system. As a response to this activation through ozone, the body's immune cells produce special messengers called cytokines. These molecules in turn activate other immune cells, setting off a cascade of positive change throughout the immune system, which is stimulated to resist diseases. This means that the application of medical ozone is extremely useful for immune activation in patients with a low immune status and/or immune deficit. Ozone causes the synthesis of biologically active substances such as interleukins, leukotrienes and prostaglandins which is beneficial in reducing inflammation and wound healing.

Antihypoxic action

Ozone brings about the rise of pO2 in tissues and improves transportation of oxygen in blood, which results in change of cellular metabolism e activation of aerobic processes (glycolysis, Krebs cycle, b-oxidation of fatty acids) and use of energetic resources. It also prevents formation of erythrocytes aggregates and increases their contact surface for oxygen transportation. Its ability to stimulate the circulation is used in the treatment of circulatory disorders and makes it valuable in revitalizing organic functions.

Analgesic & de toxicating action

Ozone causes secretion of vasodilators such as NO which is responsible for dilatation of arterioles and venules.

Bio energetic & biosynthetic action

It activates mechanisms of protein synthesis, increases amount of ribosomes and mitochondria in cells. These changes on the cellular level explain elevation of functional activity and regeneration potential of tissues and organs.

Miscellaneous actions of ozone are circulatory enhancement, disruption of tumor metabolism and stimulation of oxygen metabolism.[5]

Routes of administration

Gaseous ozone – Ozone can be used in gaseous form via an open system or via a sealing suction system to avoid inhalation and its adverse effects.

Ozonated water – Ozonated water has been shown to be very effective against bacteria, fungi and viruses.

Ozonized oil – In addition to gaseous and aqueous form, oils that are ozonized also seems extremely convenient.

Though gaseous ozone was shown to have more effective microbicidal properties than aqueous form, due to its toxic effects if inhaled, ozonated water is the most preferred form for use in dentistry. Therefore a safe system for applying gaseous ozone into the periodontal pocket that avoids inhalation still needs to be developed.[1]

Generators of ozone

The first ozone generator was developed by Werner Von Siemens in Germany in 1857. There are several different techniques used to produce therapeutic grade ozone. They are:

• **Ultraviolet system:** Produces low concentrations of ozone. It is used in esthetics, saunas and for air purification.

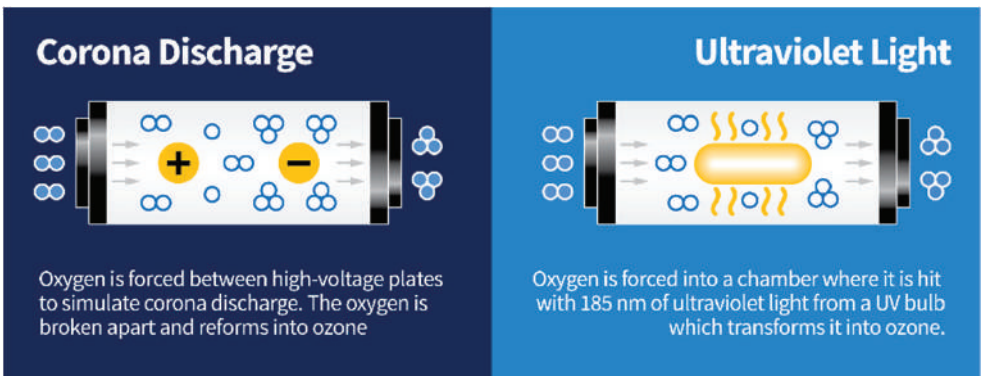

Figure 3: Generation of Ozone

Figure 4 : HealOzone

• **Corona discharge system:** Produces high concentrations of ozone. Most common system used in medical and dental field. It is easy to handle and it has a high controlled ozone production.

• **Cold plasma system:** Used in air and water purification.[1]

Dental ozone generators

A. HEAL OZONE

The ozone unit for dental use was initially developed by CurOzone Inc. (Canada) and subsequently manufactured under license and distributed by KaVo Dental GmbH and Co. (Germany) under the name "HealOzone". The Heal Ozone procedure consists of a package which includes the application of ozone gas, the use of remineralizing agents, a patient kit and information on oral hygiene. The procedure usually takes between 20 and 120 second per tooth. Immediately after ozone application the tooth surface is treated with a remineralizing solution (reductant) containing fluoride, calcium, zinc, phosphate. • HealOzone application for the treatment of non cavitated lesions is usually repeated at 3 and 6 months.

B. THE OZOTOP

The OzoTop is a free flow ozone delivery system using a corona discharge. It is a compact, easy to use tabletop unit. The system may be used in all cases where point of placement disinfection is needed, including periodontology, endodontology, restorative, implantology, apthous ulcers/herpes,dentures and impression materials. Ozone is applied at 6, 12, 18, 24 seconds, depending on which treatment is required.[6]

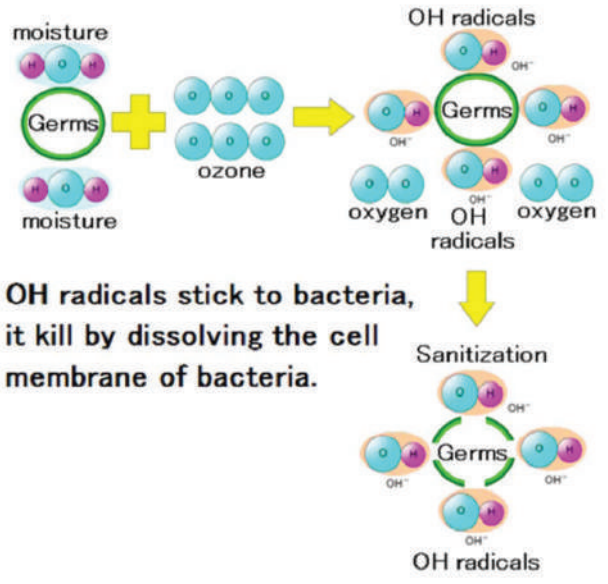

Figure 5: Mechanism of action

Advantages:

- Disinfectant.
- Anti-inflammatory.
- Activation of intracellular metabolism of oral mucosa and dentalwounds.
- Improvement of regional circulation.
- Stimulation of regenerative processes.
- Hemostasis in capillary bleedings.
- Painless procedures.

Disadvantages:

- Ozone toxicity if the level increases at 0.0007% per application.
- Instability.
- Not readily available.

Indications:

- Chronic or recurrent infections in the oral cavity.
- Prophylaxis and prevention of dental caries.
- Remineralization of pit and fissure caries, root and smooth surface caries.
- Bleaching of discolored root canal treated teeth.
- Sterilization of cavities, root canals, periodontal pockets, herpetic lesions.
- Desensitization of extremely sensitive tooth necks.
- Pre-washing of surgical sites.
- Plaque control.
- Contamination control.

Contraindications

Contra indications	Side Effets
Pregnancy	Epiphora
Hyperthyroidism	Rhinitis
Severe anemia	Cough
Severe	Headache
Active hemorrhage	Nausea and vomiting
	Thrombocytopenia
	Cardiovascular instability
	Patients on ACE inhibitors

Goals of ozone therapy

- Inactivates viruses, bacteria, yeast, fungus and protozoa.
- Stimulates the immune system, cleans arteries, veins, and improves circulation.
- Purifies the blood and lymph.
- Normalizes hormone and enzyme production.
- Reduces inflammation and pain.
- Stops bleeding.
- Prevents shock and stroke damage.
- Reduces cardiac arrhythmia.
- Improves brain function and memory.
- Oxidizes toxins allowing their excretion, chelates heavy metals.(1)

Ozone revolution in dentistry

Ozone therapy is a non surgical dental treatment. This means dentist's drill is not being used. It is painless, which unfortunately is not the case in most regular dental visits.

The vision of using ozone therapy is the patient's natural teeth can be and must be maintained in a healthy state without using drills and invasive procedures. The secret lies in early detection, prevention and the BEST NEWS – it's PAINLESS.[6]

Clinical applications of ozone in dentistry

1. Treatment of dental caries: The application of Ozone therapy in the treatment of dental caries is extensively studied and many studies have proved its effectiveness in the treatment of pit and fissure caries, root caries and interproximal caries. Ozone is delivered through a hand piece, which is equipped with a silicon cup. This treatment is an alternative therapy to conventional drilling and filling for non cavitated deciduous carious lesion.[6]

2. Endodontics: In endodontic treatment instead of using irrigation chemicals (Naocl), Ozonated water can be used for irrigation. Ozonated oils like Ozonated sunflower oil, olive oil and ground nut oil was efficient in canal sterilization than the conventional irrigation by the Sodium hypochlorite and Sodium peroxide combination.[6]

3. Boon for Periodontics: The study of effect of ozonated water on proliferation of cells in periodontal ligament has resulted in the decontamination of root surface, without negative effect on the remaining periodontal cells on root surface.[6]

4. Ozone for treatment of periimplantitis: For the prevention of periimplantitis an adequate and steady plaque control regimen must be ensured. Gasiform ozone or ozonized water shows an increased healing compared to wound healing without ozone therapy.[6]

5. Ozone therapy in oral and maxillofacial surgery: Ozone has a positive influence on bone metabolism and reparative process of the bone (Sanseverino ER et al., 1989). [6]

6. Antibacterial Effect of Ozone on Plaque biofilm: Both caries and periodontal disease are caused primarily by plaque biofilm. Ozone might be useful to control oral infectious microorganisms in dental plaque. The antimicrobial property of ozone is not only effective in reducing the number of cariogenic bacteria, but also causes significant reduction in the micro organisms present in the root canal. However it was not successful in completely eliminating these bacteria's embedded in the biofilm. Ozonated water is effective in killing grampositive, gramnegative bacteria and oral Candida albicans causing periodontal disease. Ozonated water had nearly the same antimicrobial activity as 2.5% sodium hypochlorite and also the metabolic activity of fibroblasts was high when the cells were treated with ozonated water.[5]

7. Effect of ozone on wound healing: The impact of ozone on epithelial wound healing in the oral cavity was observed by Filippi. It was found that ozone-water can be used daily to speed up the healing rate in the oral mucosa. This effect can be seen in the first two postoperative days. The comparison with wounds without treatment showed that daily treatment with ozone water accelerates the physiological healing rate. Patients under ozone therapy healed more quickly and without the need for systemic medication, compared to the control group. Application of ozone after tooth extraction reduced the post-extraction complications.[5]

8. Ozone's antiviral actions: All viruses are susceptible to ozone; yet differ widely in their sus-

ceptibility.[6]

However, the other treatment modalities where Ozone therapy works are:

Biofilm purging, Bleaching, TMJ disorders, Tissue regeneration, Pain control, Accelerated healing, Gum recession.

Ozone toxicity

Ozone inhalation can be toxic to the pulmonary system and other organs. Complications caused by ozone therapy are infrequent at 0.0007 per application. Known side effects are upper respiratory irritation, rhinitis, cough, headache, occasional nausea, vomiting, shortness of breath, blood vessel swelling, poor circulation, heart problems. European cooperation of medical ozone societies prohibited the intravenous injections of ozone gas due to risk of air embolism.[6]

Cure for ozone toxicity

The patient must be placed in the supine position. The patient should inhale the humid oxygen and treated with Vitamin E, & ascorbic acid.[6]

Ozone and covid-19 - ozone treatment on PPE

Ozone can successfully eliminate SARS-CoV-2 from the surface of PPE gowns and face masks, with a viricidal effect depending on ozone concentrations, exposure times, and relative humidity. The mechanisms of action of ozone depend on its strong oxidant effect, which explains its induced oxidative stress and its broad antimicrobial spectrum. This effect is mediated by peroxidation and damage of polyunsaturated fatty acids from cell membranes (in bacteria, mould, yeast, and spores), proteins (especially S-proteins), and lipids of capsid and viral envelopment, as well as by inducing indirect damage to DNA and RNA.[6]

Conclusion

Since its introduction in 1840, ozone therapy is proving to be a new therapeutic modality with great benefits to the patients. The potent antimicrobial power of ozone, along with its capacity to stimulate the circulatory system and modulate immune response, makes it a therapeutic agent of choice in treatment of medical pathologies and infectious diseases. Its atraumatic, painless, non invasive nature and relative absence of discomfort increase patient's acceptability and compliance thus making it an ideal treatment choice.

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Photodynamic Therapy - An Emerging Therapeutic Venture in Periodontics: A Review

Linn Mary Sajeev[1], Sanjeev Raveendran[2], Shyamala Devi M.P[3]

ABSTRACT

Periodontitis is an infectious and inflammatory disease where specific dental plaque pathogens are associated with the onset and severity of tissue destruction. Photodynamic therapy (PDT) has been proposed as a novel disinfection method, which may be a potential treatment for several infectious diseases by eradicating microorganisms. Due to the high antibacterial potential, PDT has emerged as a beneficial tool in the treatment of chronic periodontitis and peri-implantitis, particularly in elimination of subgingival pathogens from areas such as deep pockets, root concavities, and furcations. Positive effects of adjunctive PDT have been reported on the clinical, biochemical and microbiologic parameters. The objective of this article is to provide an overview of PDT and its applications in periodontics.

Key words: photodynamic therapy, periodontitis, peri implantitis, adjunctive treatment, SARS-COV 2

Introduction

Photodynamic therapy (PDT) has emerged recently as a new non-invasive treatment modality. It is based on light induced inactivation of bacteria and has two essential components: a photosensitizing agent (e.g., toluidine blue and methylene blue) and light energy. A photosensitizer that absorbs light binds to the outer membrane of target bacteria and induces the formation of reactive oxygen species (ROS), causing localized photo damage and cell death.[1] In dentistry PDT has been proposed as novel disinfection method which may be potential treatment for several infectious diseases by eradicating microorganisms. This mode of usage is often mentioned as antimicrobial PDT (aPDT). Due to high antimicrobial potential, PDT has been proposed in treatment of chronic periodontitis,peri implantitis and endodontic infections.[2]

The aim of this review is to provide a comprehensive overview of PDT and its applications in periodontics.

History

The use of photodynamic therapy for inactivating microorganisms was first demonstrated more than 100 years ago, in 1900 when Oscar Rabb (Rabb 1900) reported the lethal effects of acridine hydrochloride and visible light on Paramecium caudatum. PDT was introduced in medical therapy in 1904, as the light induced inactivation of cells, microorganisms or molecules (Von Tappeiner and Jodlbauer 1904). In 1913, Friedrich Meyer Betz, the German physician performed the pioneering study which was at first called Photo-radiation Therapy with porphyrins. It was John Toth who acknowledged the photodynamic chemical effect of therapy with early clinical argon due

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lasers and wrote the first white paper renaming the therapy as photodynamic therapy. Thomas Dougherty formed the international photodynamic association in 1986. PDT was first approved by drug and food administration in 1999 to treat precancerous skin lesions on face and scalp (Babilas et al. 2005). Photodynamic therapy has emerged as an alternative to antimicrobial regimes and mechanical means in eliminating dental plaque of species owing to the groundbreaking work of Professor Michael Wilson and colleagues (Wilson 1993) at the Eastman Dental Institute, University College London, UK.[3]

Mechanism of Action

The three components of PDT are oxygen, photosensitizer, and light. When a photosensitizer is administered to the patient and irradiated with a suitable wavelength, it goes to an excited state from its ground state. This excited state can then decay back to its ground state or form the higher energy triplet state. The triplet state photosensitizer can react with biomolecules in two different pathways - type I and II.

Type I: It involves electron/hydrogen transfer directly from the photosensitizer, producing ions, or electron/hydrogen removal from a substrate molecule to form free radicals. These radicals react rapidly with oxygen, resulting in the production of highly reactive oxygen species (superoxide, hydroxyl radicals, and hydrogen peroxide) (Khurana et al 2014).

Type II: In type II reaction, the triplet state photosensitizer reacts with oxygen to produce an electronically excited and highly reactive state of oxygen, known as singlet oxygen which can interact with a large number of biological substrates inducing oxidative damage on the cell membrane and cell wall. Microorganisms that are killed by singlet oxygen include viruses, bacteria, and fungi. Singlet oxygen has a short lifetime in biological systems and a very short radius of action (0.02 mm). Hence, the reaction takes place within a limited space, leading to a localized response; thus making it ideal for application to localized sites without affecting distant cells or organs. Thus, the type II reaction is accepted as the major pathway in microbial cell damage(Moan et al 1991).[4]

Photosensitizers

Most of the sensitizers used for medical purposes belong to the following basic structures:

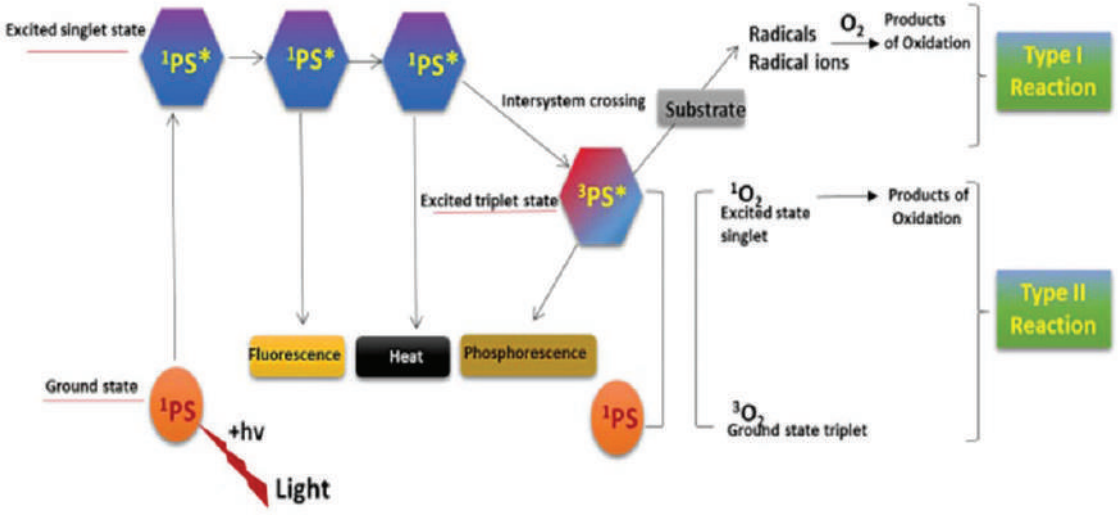

Fig:1-The schematic representation of Type I and Type II reactions in photodynamic therapy (Adapted from Khurana et al 2014). After exposure to light, the activated photosensitizer during excited triplet state, tracks either of the two pathways. Type I pathway includes electron- transfer reactions from the photosensitizer triplet state by the participation of a substrate to produce radical ions which react with oxygen to produce cytotoxic species. Type II pathway includes energy transfer from the photosensitizer triplet state to the ground state molecular oxygen (triplet) to produce excited state singlet oxygen, which oxidizes biological molecules. hv= photon energy; PS= photosensitizer.[7]

1. Tricyclic dyes with different meso atoms, acridine orange, proflavine, riboflavin, methylene blue, fluorescein, eosin, erythrosine, rose Bengal.

2. Tetrapyrroles, porphyrins and derivatives, chlorophyll, phylloerythrin, phthalocyanines.

3. Furocoumarins, psoralen and its methoxy derivatives- xanthotoxin, bergaptene.

Source of Light

Diode laser systems: They are easy to handle, portable, and cost-effective.

Non Coherent light sources: Preferred for treatment of larger areas and include tungsten filament, quartz halogen, xenon arc, metal halide, and phosphor-coated sodium lamps.

Non-laser light sources include light-emitting diodes (LEDs). They are economical, light weight, and highly flexible.[5]

Application in Periodontics

1. Effects of adjunctive antimicrobial photodynamic therapy (aPDT)

a. On clinical results

i. On biochemical results

ii. On microbiological results

a) On clinical results

Within the context of periodontal treatment, aPDT is regarded as an adjunctive treatment option. However, it is a relatively new approach, the clinical data is rather sparse and long-term-studies are required to better understand its potential. Braun et al conducted a split mouth study and reported that adjunctive use of aPDT has a positive effect on the treatment outcome. The relative attachment level gain amounted to 0.67 mm for the test quadrants (SRP+aPDT) and 0.35 mm for the control quadrants (SRP).[6] Andersen et al. observed that clinical attachment gain was 0.86 mm and 0.36 mm for the test (SRP+aPDT) and control (SRP), respectively, and the difference between the study groups was significant.[7] In both studies there was a significant difference also in the bleeding scores favoring the combined treatment protocol. The authors concluded that a single episode of aPDT has a beneficial effect in addition to SRP. Lulic investigated the effect of repeated aPDT in the maintenance patients and the clinical parameters were monitored for up to 12 months. Residual pocket depths received either SRP+aPDT (with 5 applications) or SRP alone. The SRP+aPDT group presented significantly higher probing depth reduction and clinical attachment gain than the SRP group at 6 months. The difference in bleeding on probing was significant in the test group at all follow-ups.

Treatment of chronic periodontitis

Sigusch et al showed that a single application of aPDT 3 weeks after SRP improves bleeding on probing, probing depth and clinical attachment level in chronic periodontitis.[8] Betsy et al evaluated the potential of aPDT as an adjunct to SRP in the treatment of chronic periodontitis. In a single centered, randomized and controlled clinical trial, 90 patients with untreated chronic periodontitis were randomly assigned to receive SRP with aPDT (test group) or SRP alone (control group). Probing depth and clinical attachment level showed significantly higher reductions in the test group at 3 and 6 months than the control group. They concluded that aPDT acts as a beneficial adjunct to SRP in non-surgical treatment of chronic periodontitis in short-term follow-up.[9]

Treatment of aggressive periodontitis

Certain researches on the impact of PDT in the patients with aggressive periodontitis have shown desirable results for the state of subgingival flora (Novaes et al, De Oliveira et al, Moreira et al). It has been recommended that both SRP and PDT could be useful in the nonsurgical therapy for the aggressive periodontitis. The report from Moreira et al showed additional immunological, microbiological, and clinical benefits of PDT in patients with aggressive periodontitis.[10] A systematic review conducted by Chatzopoulos et al to assess the efficacy and safety of PDT with or without SRP. It was found that PDT may show a beneficial role in the therapy of aggressive periodontitis after repeated applications.[11]

On the other hand, there are studies not confirming the superiority of SRP+aPDT over SRP alone in the treatment of periodontitis. Polansky et al reported

no significant differences in clinical periodontal parameters between the study groups. Balata et al concluded that aPDT does not provide any additional benefits to conventional, ultrasonic debridement in patients with severe chronic periodontitis.[1] A recent clinical trial conducted by Boreki et al (2019) showed that usage of PDT as adjunct to SRP does not lead to any beneficial effects on the investigated clinical and microbiological parameters except for sulcus bleeding index. Souza E in his systematic review stated that PDT did not show additional benefits as compared to SRP alone in treatment of aggressive periodontitis.

i) On biochemical results

So far, a few studies assessed the possible effects of adjunctive aPDT on the biochemical parameters. Franco et al found that the application of aPDT in conjunction with conventional SRP leads to significant up-regulation of receptor activator of nuclear factor kappa B (RANK), osteoprotegerin (OPG) and fibroblast growth factor 2 (FGF2) compared to SRP alone. In a split-mouth randomized clinical study, clinical parameters and cytokine profiles in gingival crevicular fluid of patients with chronic periodontitis who have been treated using SRP alone or SRP+aPDT were evaluated. Tumor necrosis factor-alpha (TNF-a) level was reduced significantly in the sites treated with SRP+aPDT compared to those sites treated with SRP alone. However, interleukin-1beta (IL1), MMP-8, MMP- 9 levels and clinical periodontal parameters were similar in the study groups.[12]

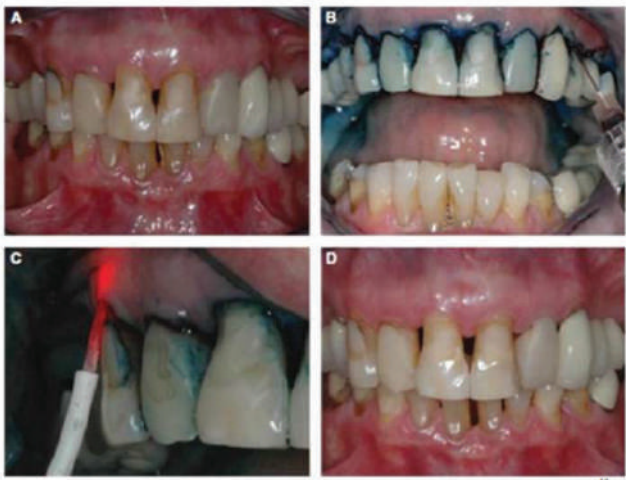

Fig 2:Application of aPDT in periodontal disease site[19]

ii)On microbiological results

In microbiological analysis, there was significant reduction for Fusobacterium nucleatum and Eubacterium nodatum at 3 months and Eikenella corrodens and Capnocytophaga species at 6 months in the SRP+aPDT group compared to the SRP alone. Sigusch et al showed that a single application of aPDT 3 weeks after SRP significantly reduced the level of Fusobacterium nucleatum in patients with localized chronic periodontitis. The level of Fusobacterium nucleatum remained very low throughout the whole observation period (up to 3 months), whereas in the control group, there was only a slight decrease after SRP that returned to the baseline levels during the study period.[8] Authors have shown that aPDT has growth-inhibiting effects on Porphyromonas gingivalis and inactivates its protease. Photodynamic therapy in the absence of a photosensitizer is effective against some microorganisms associated with periodontal disease, including oral black-pigmented bacteria such as Porphyromonas gingivalis, Prevotella intermedia, and Prevotella nigrescens.[13]

b) Use of aPDT in peri implant disease

It has been proven by the treatment of peri-implantitis that complete eradication of causative bacteria is responsible for development of periodontal disease and disinfection or detoxification of peri implant pockets are essential to achieve effective healing with regeneration of lost bone around the affected implants (Mombelli. 1992, 1987).[3] Conventional mechanical methods are apparently ineffective for complete debridement of the bone defect as well as of the contaminated microstructured implant surface. Thus, adjunctive application of systemic or local antibiotics and antiseptics has been generally recommended (RoosJansaker 2003). However, because of the potential problems related to antibiotics (such as resistance), and the generally insufficient effect of the antimicrobial agents for bacterial eradication as well as poor results of re-osseointegration following their adjunctive application during nonsurgical and surgical therapy of peri-implantitis, novel approaches are still

necessary. aPDT has emerged as unique therapeutic approach towards treatment of periimplantitis. Bassetti et al compared the results of non-surgical treatment of initial peri-implantitis either with adjunctive minocycline microspheres or aPDT. Non-surgical mechanical debridement with adjunctive aPDT was equally effective in the reduction of mucosal inflammation as the adjunctive delivery of minocycline microspheres up to a 12 months period.[14] Deppe et al reported that phototherapy on moderate and severe peri-implantitis cases significantly reduced the clinical attachment level as well as bleeding index values.[15]

Recent Advances

a) Antibody-targeted antibacterial approaches using photodynamic therapy

Antibodies conjugated with photosensitizers have been used to target Staphylococcus aureus. Selective killing of P. gingivalis was achieved in the presence of Streptococcus sanguinis (previously S. sanguis) or in human gingival fibroblasts using a murine monoclonal antibody against P. gingivalis lipopolysaccharide conjugated with toluidine blue O. In two studies, bacteriophages were used as vehicles to deliver the photosensitizer tin (IV) chlorine e6 to the surface of S. aureus strains. This led to approximately 99.7% killing of microorganisms. The combination of pulsed laser energy and absorbing gold nanoparticles selectively attached to the bacterium for killing of microorganisms is a new technology that was introduced recently.[16]

b) Nanoparticle-based antimicrobial photodynamic therapy

Incomplete penetration of methylene blue in oral biofilms may become greater in a clinical setting, where both the photoactive compound and light should be applied for periods of up to 15 min. Therefore, one of the ways to overcome these deficiencies is to develop delivery systems that significantly improve the pharmacological characteristics of methylene blue. Recently,it was proposed that encapsulation of methylene blue within poly (D, Llactide- co-glycolide) (PLGA) nanoparticles (150–200 nm in diameter) that may offer a novel design of nanoplatform for enhanced drug delivery and photodestruction of oral biofilms.[17]

Advantages of Antimicrobial Photodynamic Therapy

One of the greatest hits of photodynamic therapy is the double selectivity obtained by targeting the photo sensitizer, derived from its high affinity for microbial cells, and the light, implying that only the infected area is irradiated and, consequently, treated. aPDT is safe for human tissue as the photo sensitizer typically shows a higher affinity against microbial cells. The results are instantaneous while antibiotics take several days to act. The therapeutic window of APDT is broader than other antimicrobial therapies, even against pathogenic

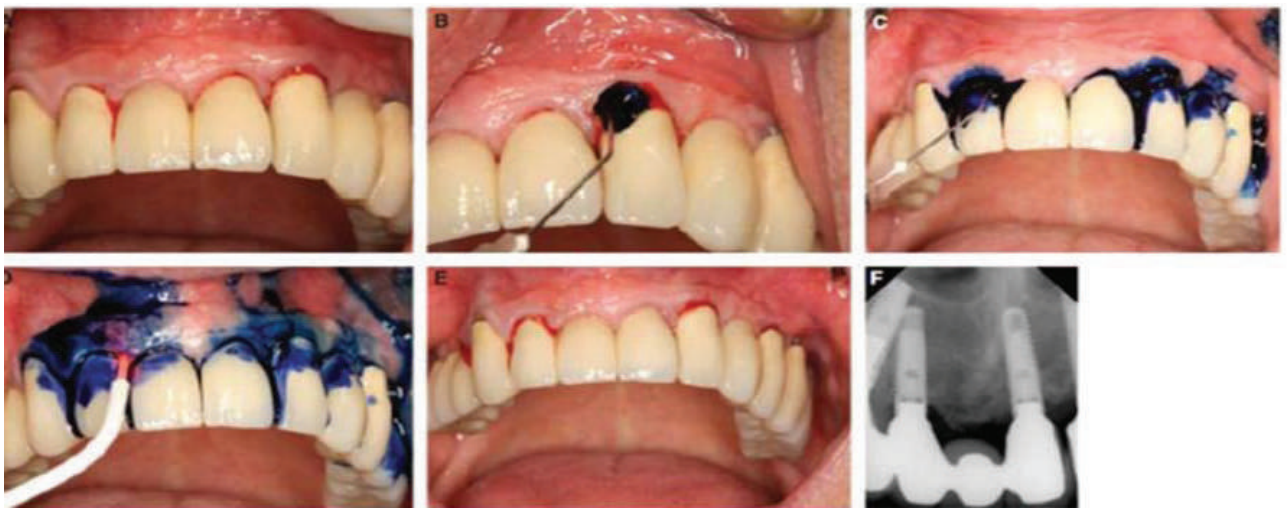

Fig 3: Application of antimicrobial photodynamic therapy in peri-implant site.20

biofilms. Because of the high reactivity of ROS, secreted virulence factors can be destroyed as these are commonly proteins, enzymes or amino acid residues. Besides, aPDT cannot easily induce the development of microbial resistance.[16]

Adverse Effects

PDT has a potential of phototoxic or photoallergic unwanted side effects (Kubler et al. 2002). There can be impairment of benign oral flora which may lead to the overgrowth of single resistant species (Roberts et al. 2002). In order to avoid phototoxic reactions, it is more important to stain selectively the target leaving out the gingival mucosa or tongue. Burning sensation stinging or prickling is a common complaint experienced during PDT (Lui et al. 1993; Kalker et al 2002). It usually occurs in the early part of light exposure. A clinically obvious scar is rarely observed. Hyperpigmentation or hypopigmentation can occasionally be seen in treated areas and resolve within six months.

Future Directions

The concept of photodynamic therapy itself is very attractive because it selects the target tissue by "marking" it with the photosensitizer, and the therapy is focused only on "marked" cells or tissues. Development of new photosensitizers, more efficient light delivery systems, and further studies are required to establish the optimum treatment parameters before investigators can proceed to clinical trials and eventual clinical use. Photodynamic antimicrobial chemotherapy (aPDT) appears to be the most efficient for the treatment of localized and superficial infections such as mucosal and endodontic infections, periodontal diseases, caries, and peri-implantitis, which are the potential targets. The future of PDT will depend on the interactions between clinical applications and technological innovations. Only interdisciplinary research approaches can overcome all the difficulties and challenges of PDT.[5]

Clinical Application of PDT for SARS-COV 2 Treatment

The control of SARS-COV 2 virus replication is crucial to limit the progress of covid-19. PDT might be effective as it inactivates viruses and reduce viral load in nasal and oropharyngeal membrane epithelial cells. Recently a study reported successful use of PDT in disinfection of oral and nasal cavities in patients with early stage covid-19. Further studies are required to validate the finding and test the therapeutic efficacy in patients with different stages of covid 19.[18]

Conclusion

Antimicrobial photodynamic therapy is an interesting therapeutic approach in the direction of the treatment of periodontitis and peri-implantitis. Various studies suggest the effective and efficient bactericidal effect of antimicrobial PDT. However, further in vivo and clinical studies are necessary to determine the optimal conditions of this novel therapy. Low toxicity and rapidity of effects are the good qualities of PDT. Antimicrobial PDT may hold a promise as a substitute for currently available chemotherapy in the treatment of periodontal and peri-implant diseases.

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Chair Side Tests: En Route to Smarter Periodontics

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ABSTRACT

Medical diagnosis is very complex procedure that involves patient's history, personal examinations and various investigations, which allows more comprehensive understanding of patient's ailments. In a periodontal context, we know periodontal diseases are multifactorial which makes diagnosis more complex. Before the advent of the present diagnostic methods, dentist's relied on the basic and inconsistent diagnostic methods which could not properly address the underlying cause of the disease. Since, technology have a come along way this article aimed to review the more advanced chairside diagnostic methods used in dentistry which could make our diagnosis more precise in very less time.

Key Words: Diagnosis, Periodontitis, Microbiological Tests, Biochemical Tests, Genetic Tests.

Introduction

A correct diagnosis is three fourths the remedy- M.K.Gandhi.

Diagnosis is the identification of a condition, disease, disorder, or problem by systematic analysis of the background or history, examination of the signs or symptoms, evaluation of the research or test results, and investigation of the assumed or probable causes. Effective prognosis is not possible without an effective diagnosis.[1]

Periodontitis is a group of inflammatory diseases that affect the connective tissue attachment and supporting bone around the teeth. The initiation and the progression of periodontitis are dependent on the presence of virulent micro-organisms capable of causing the disease.[2]

The aim of periodontal diagnostic methods is to provide functional information to the practitioner regarding the present periodontal disease, type, location and severity. This essential data serves as a basis for treatment planning and provides a record during periodontal maintenance and disease monitoring phases of treatment.

Traditional periodontal diagnostic methods are not precisely accurate and only allow retrospective diagnosis of attachment loss. Development of reliable predictive tests can foresee future periodontal status and thus enable definitive treatments to be given for each specific site before extensive damage has occurred.[3]

During the 1990s there has been an emergence of a multitude of diagnostic tests based on physical, chemical, microbiological and immunological approaches. The philosophy behind the emergence of such tests is that the earlier the active disease is diagnosed, the less invasive treatment is required. The

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patient also has a reduced chair time, reduced expense and a better the long-term prognosis.[4]

According to Chapple for periodontal diagnosis, the ideal diagnostic test should be:[5]

- Quantitative.
- Highly sensitive method capable of analysing a single periodontal site in health as well as disease.
- Reproducible.
- Highly specific.
- Simple to perform.
- A rapid, one or two stage procedure.
- Non-invasive.
- Versatile in terms of sample handling, storage and transport.
- Amendable to chair side use.
- Economical.
- Dependent upon simple and robust instrumentation.

Chair side periodontal test kits can be categorized as

- Microbiological test kits
- Biochemical test kits
- Genetic kits
- Kits under development

Table 1 : Commercial Diagnostic Kits

COMMERCIAL NAME	PURPOSE
PERIOTEMP	Gingival temperature
PERIOTEST	Tooth and implant mobility
PERIOSCOPY, DETECTOR, AND DIAGNODENT	
Detection of calculus	
KEYLASER 3	Combined detection and removal of calculus
PERIOSCAN	Detection of BANA organisms and calculus
HALIMETER, ORALCHROMA and DIAMOND PROBE / PERIO 2000	Halitosis
EVALUSITE	Detection Of Aa,Pg And Pi
PERIOCHECK	Neutral Proteinase
PST	Genetic Susceptibility
PROGNOSTIK AND BIOLISE	Elastase
PERIOGUARD AND POCKET WATCH	AST
TOPAS	Detection of toxins from GCF
TOPAS	Bacterial toxins and proteases
MMP DIPSTICK TEST	MMP 8
EVALUSITE	ELISA For Aa, Pg And Pi
MYPERIOPATH	RT-PCR
PST AND MYPERIOID	Genetic susceptibility test
PAROCHECK AND PHYLOCHIP	Oligonucleotide microarray technology
OMNIGENE	Nucleic Acid Probe

1. Microbiological Test Kits

The utilization of microbiological detection techniques has the potential to lead to an improved management of the periodontitis patients.[6] The bacteriological tests are mainly aimed at spirochetes, Aa, Pg and Pi. While P.gingivalis, A.actinomycetemcomitans .and P. intermedia are often found in increased levels in diseased periodontal lesions, low levels of each species have been observed in healthy sites.[7] Detection and differentiation of the bacteria requires approximately 5 min and the results are interpreted visually. Comparisons to bacterial culture have shown that positive test results generally indicate the Presence of greater than 104 recoverable Counts of Agregatibacter*actinomycetemcomitans*, Porphyromonas*gingivalis* or Prevotella*intermedia* in subgingival plaque.[8]

Meridol Periodiagnostics

It is a real – time PCR for the quantitative determination of the six most important marker organisms of periodontitis and peri-implantitis and the total bacterial load.[9] The marker organisms are Aggregatibacter*actinomycetemcomitans*, Porphyromonas*gingivalis*, Tanerella*forsythus,* Treponema*denticola,* Fusobacteri-

um *nucleatum* and Prevotella *intermedia*. It combines high specificity with high sensitivity and a precise quantification. The detection limit, at 100 bacterial cells per type of pathogen, is far below the limits of methods available. Making it highly sensitive.[3]

Microdent Test

This test identifies the bacterial genomic DNA analysis of five different species of periodontopathogenic bacteria present in the subgingival biofilm, specifically: Actinobacillus *actinomycetemcomitans,* Porphyromonas *gingivalis,* Prevotella *intermedia,* Bacterioides-*forsythus,* Treponema *denticola*. The plaque samples are analysed by Multiplex-PCR, inverse hybridisation for the identification which includes the following steps as detailed below.

The isolated DNA (DNA extraction from the small cone) is amplified (multiplex PCR) in the 16Sr-RNA region with biotin-labelled primers. The fragments of the amplified DNA were then used for the inverse hybridisation test, which starts by denaturing the amplified DNA. Subsequently, the hybridisation buffer is added to the strip coaptated with 2 control lines and the specific probes for the 5 different species. In the event that the amplified DNA belongs to an identified strain, it will bind to the corresponding and complementary probe during incubation in a shaking water bath. After the addition of streptavidine, conjugated with alkaline phosphatase, to the hybrid formed by the probe and the biotin-labelled amplified DNA, the complex becomes visible upon addition of NBT/BCIP.[10]

Table 2: Pathogens detectable with Parocheck Kit

With ParoCheck® Kit 20 Detectable Periodontal Pathogens			
Actinobacillus actinomycetemcomitans	*Campylobacter rectus/showae*	*Porphyromonas gingivalis*	*Treponema denticola*
Actinomyces odontolyticus	*Capnocytophaga gingivalis/sputigena/ochracea*	*Prevotella intermedia*	*Veillonella parvula*
Actinomyces viscosus	*Eikenella corrodens*	*Prevotella nigrescens*	
Tannerella forsythia (synonym: Bacteroides forsythus; Tannerella forsythensis)	*Eubacterium nodatum*	*Streptococcus constellatus group**	
Campylobacter concisus	*Fusobacterium nucleatum*	*Streptococcus gordonii group**	
Campylobacter gracilis	*Peptostreptococcus micros*	*Streptococcus mitis group**	

With ParoCheck® Kit 10 Detectable Periodontal Pathogens			
Actinobacillus actinomycetemcomitans	*Campylobacter rectus/showae*	*Porphyromonas gingivalis*	*Treponema denticola*
Actinomyces viscosus	*Eikenella corrodens*	*Prevotella intermedia*	
Tannerella forsythia (synonym: Bacteroides forsythus; Tannerella forsythensis)	*Fusobacterium nucleatum*	*Peptostreptococcus micros*	

MyPerioPath

MyPerioPath provides DNA-PCR assessment of periodontal disease bacteria via simple salivary testing. OralDNA Labs' MyPerioPath is a simple, chairside salivary test that detects the presence and quantity of specific bacteria associated with periodontal disease. Based on DNA polymerase chain reaction (PCR) testing, the molecular test enables early and accurate diagnosis and provides the information needed to design treatment plans tailored specifically to each patient, thus ensuring more predictable outcomes.[11]

Parocheck

Is the first DNA chip for the detection of periodontitis associated Pathogens. Parocheck™ was developed in a co-operation between Lambda and Greiner Bio-One and allows the rapid and exact determination of a total of 10 or 20 Different periodontal pathogens. Parocheck™ thus enables an as yet unique monitoring of pathogens in all areas of periodontal disease, such as:

- juvenile periodontitis
- chronic adult periodontitis
- aggressive periodontitis•
- refractory and marginal periodontitis

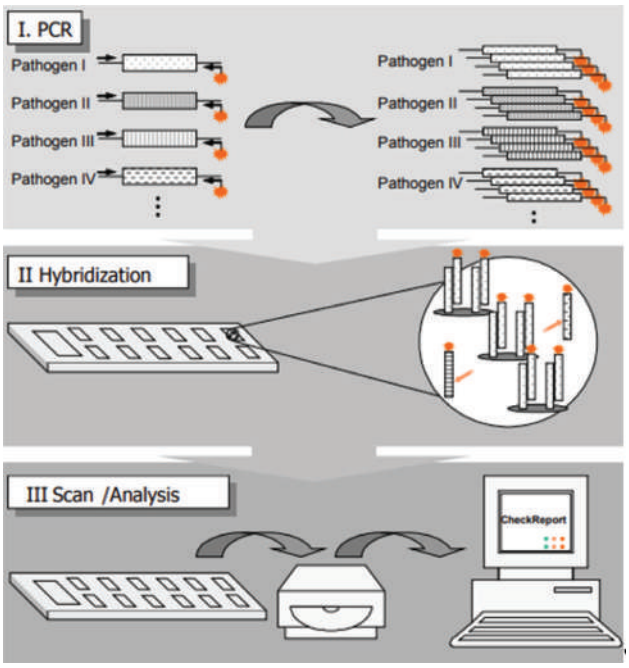

Figure 1: Principle of the ParoCheckAssay

The principle of the assay is based on the detection of the pathogen-specific 16S rRNA gene. After taking a patient specimen, the bacterial DNA is extracted (specimen collection and DNA extraction kits are not provided). Subsequently a DNA fragment of about 300 nucleotides, coding for the 16S rRNA genes of microorganisms existing in the specimen, is amplified in the presence of only one highly conserved pair of primers with the aid of the polymerase chain reaction. The polymerase chain reaction was designed in such a way that single-stranded DNA fragments are formed, which are fluorescence-labelled with Cy5. The labeled amplified fragments are then hybridized to pathogen-specific DNA probes derived from the area of the 16S rRNA gene and fixed to the periodontitis DNA chip. After hybridization, analysis can be performed with any microarray scanner which is able to handle the dimensions of a microscopic slide (25 mm x 75 mm). The following wavelengths are required for detection: ~532 nm (Cy3) and ~635nm (Cy5). Using the CheckScanner and the CheckReport software, the evaluation and creation of the ParoCheck™ report are easy and fast. Automated interpretation of the on-chip controls and perfect data administration fulfill all needs required for a diagnostic set-up. Optional, images generated by an Axon 4000A, 4000B or 4100A personal scanner can be imported and analyzed using the CheckReport software.[12]

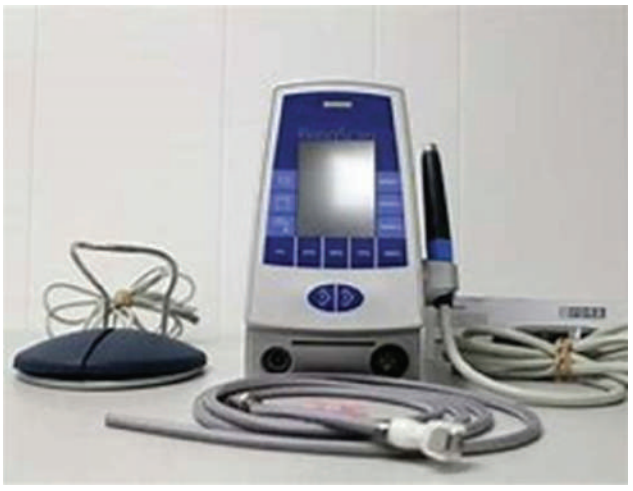

Figure 2: Perioscan

2. Biochemical Test Kits

• Commericial kits based on host cell death and tissue degradation products.

These kits are based on factors released from tissue degradation is that based on GCF Aspartate aminotransferase transferase (AST) which is released from dead cells. Examples of such kits are perioguard and pocket watch.

• Commericial kits based on GCF proteolytic and hydrolytic enzyme levels.

These systems detects the presence of neutral proteases such as collagenase in GCF.

- Periocheck
- Prognostik
- TOPAS Tm (toxicity pre-screeningassay)
- PERIO 2000

Perioscan

PERIOSCAN is a chair side test kit system which uses the BANA test for bacterial trypsin-like proteases. These are mainly produced by P.*gingivalis,* but lesser amounts are also produced by T.*forsythia* and T.*denticola*. The plaque sample is exposed to a substrate that can only be hydrolyzedby a specific enzyme. Since some of these species grow poorly in cultures and account for a significant proportion of the protease activity of the subgingival flora, these enzyme as says provide a rapid and inexpensive method of screening samples of these bacteria(10) The PERIOSCAN works by detecting the activity of this enzyme and it can be measured with the hydrolysis of the colourless substrate N-benzoyl-dL arginine-2-naphthylamide (BANA). When the hydrolysis takes place, it releases the chromophore β -naphthylamide, which turns orange red when a drop of Fast Garnet added to the solution. The system is particularly simple to use. This method has recently been made more sensitive.[13]

Evalusite (Kodak)

Evalusite is a diagnostic kit that is based on a novel membrane-based enzyme immunoassay for the detection of three putative periodontopathogens: Aa, Pg and Pi. A paper point subgingival plaque sample is collected and added to asample tube. The sample is placed within the kit,which employs a sandwich-type ELISA (enzyme-linked immunosorbent) and a pink spot is displayed if the test organism is present. It was designed to detect levels of colonization of bacteria present in periodontally diseased sites in number expected. Detection and differentiation of the bacteria requires approximately 5 min and the results are interpreted visually. Comparisons to bacterial culture have shown that positive test results generally indicate the Presence of greater than 104 recoverable Counts of Agregatibacter*actinomyceterncomitans*. Porphyromonas-*gingivalis*. or Prevotella*intermedia* in subgingival plaque. The test Format is also conducive to sample Pooling since minimal sample dilution occurs when multiple samples are placed in a single sample tube. This feature facilitates patient-based determinations of bacterial colonization.[8]

Halimeter

The HalimeterR (Interscan, Chatsworth, CA) is a portable sulphur monitor developed by Rosenberg and co-workers in 1991.

This device uses a voltametric sensor that generates a signal when exposed to sulphur-containing gases. Electrochemical reactions with the sulphur-containing compounds generate an electric current, which is directly proportional to the levels of VSCs. It measures the global concentration of sulphur compounds, but without discriminating them. The HalimeterR has a high sensitivity for hydrogen sulphide, but a lower sensitivity for methyl mercaptan.[14]

Figure 3 :Halimeter

Periocheck

Periocheck (Advanced Clinical Technologies Inc., Westwood, MA 02090, USA) is a rapid chairside test to detect the presence of neutral proteases (Bowers & Zahradnik 1989). The presence of these enzymes has been implicated in collagen breakdown which is an important feature of periodontal disease (Eley & Cox 1995). Crevicular fluid is collected on filter paper strips and these are placed on a collagen dye labelled gel matrix. Soluble dye-labelled fragments of collagen are formed from the reaction of neutral proteases with the gel and these diffuse onto the sample strip turning the papers colour to blue. The quantity and intensity of the colour reaction is compared to a standard colour chart and is related to the level of neutral protease activity originally present in the crevicular fluid sample.[15]

Prognostik

This system detects the presence of the serine proteinase, elastase in GCF sample. A GCF sample is collected on special filter paper strips which have been impregnated with the appropriate peptidylderivative of 7-aminotrifluoromethylcoumarin (AFC). The substrate used detects elastase and is linked to a fluorescent leaving, AFC. If elastase is present the sample reacts with the substrate in 4-8 minutes releasing the fluorescent leaving group, AFC. This produces green fluorescence in the strip which can be seen under ultraviolet (UV) light using a UV light box. The intensity of the fluorescence is proportional to the amount of GCF in the sample and this is scored by comparing it with AFC standards. The evolution of micro chips and micro fluidic platforms for salivary components may have great possibilities in the use of oral fluid for point-of-care testing. These systems use small sample and reagent volumes coupled with integrated detection methods to perform analyses. Researchers are design in glabon-a-chip prototypes handheld, automated, easy-to-use and integrated systems will enable simultaneous and rapid detectionof multiple salivary protein and nucleic acid targets.[16,17]

TopasTm (toxicitypre-screeningassay)

A new TOPAS TM test kit has been introduced to detect elevated levels of bacterial toxins and increased levels of human and bacterial inflammatory proteins. The first generation TOPAS was a manual test and the latest second generation TOPAS TM is an automated one. It is a simple, painless test which can be performed by any medical professional in only 7 minutes. The intensity of the blue colour produced by the assay is proportional to the amount of total proteins present in the GCF.[18]

Perio 2000

Various pathogenic microorganisms like P. gingivalis, P.intermedia and T.forsythia produce sulphates, leading to elevated levels of volatile sulphide compounds (VSCs) by degradation of serum proteins: cysteine and methionine. Since these VSCs can directly degrade periodontal structures so they may aggravate periodontitis and their evaluation can indicate the subgingival microbial load. The Perio2000 system is designed to display the sulphide level digitally at each site. The probe tip should be hydrated using sterile wash solution provided by the manufacturer and then inserted subgingivally at peak or hold operational mode. After a positive reading, the tip is washed and reinserted in other subgingival site.[3]

MMP Dipstick Test

The MMP-8 test stick is based on the immunochromatography principle that uses two monoclonal antibodies specific for different epitopes of MMP-8;the antibody detects both neutrophil (PMN) and non-PMN-type MMP-8 isoforms. One is immobilized onto a nitrocellulose membrane to form a catching zone and the other onto blue latex particles. Prior to testing, the crown of the tooth was gently cleaned, dried and isolated with cotton rolls to exclude contamination with saliva. The tip of a filter-paper sampling strip for absorbing GCF was gently placed into the gingival sulcus for 30 s, avoiding any bleeding from the marginal gingiva. The sampling strip was then placed into a test tube containing 0.5 ml of HEPES-buffer, pH 7.4. The proteins absorbed by the sampling strip were then eluted into the buffer for 5 min. The tip of an MMP-8 test stick was then immersed in the buffer for about 10 s. Fluid is absorbed into the stick and MMP-8 in the buffer migrates along the test stick and

binds to the blue antibody labelled latex particles on the stick. The blue latex particles then migrate with the sample fluid across the nitrocellulose membrane over the catching zone containing the other MMP-8 antibody. A sufficient MMP-8 concentration in the sample results in a blue line in this zone when MMP-8 carrying latex is bound to it. The test is positive if the blue line appears in 5 mins.[19]

Pocket Watch

It is one of the simplest tests for analysing Aspartate aminotransferase (AST) at the chair side and it is suggested that AST levels may help to attune the clinical measurements in subjects with chronic periodontitis. The GCF sample paper strip is placed in a well on the reagent coated test tray that is a part of pocket watch kit and 1 drop of AST positive control solution is added to another non-sample well. The tray is incubated for 10 minutes at room temperature for colour development. If the GCF sample after incubation shows the same colour or lighter colour than AST positive control, it is given a score of 2. A sample is given a score of 1 if its colour is the same as or lighter than the AST standard sample. A score 0 is given if it is darker than AST standard sample. Pocket watch provides an index of cell death.[3]

Perioguard

Test kit uses paper point GCF samples and calorimetric detection. This is based on Aspartate Transaminase (AST). The test kit consists of a tray with two test wells for each tooth and appropriate reagents for conducting the test. The GCF sample is obtained on a strip and is placed in to a suitable test well with two drops of one reagent. At the same time positive and negative control wells are prepared using strips provided. Two drops of a solution provided are added to the wells and are allowed to incubate at room temperature. The test results can be visually appreciated by comparing the test well colour to the colour of the positive control. A colour of greater intensity to that of the negative control is scored as positive and one of lesser or equal intensity as a negative result. The test is designed to be positive at 800mlU of AST activity and negative at values<800mlU.[20]

3. Genetic Kits

A lot of research now a day has been aimed at detection of various gene polymorphisms. Kornman et al found an association between the polymorphism in the genes encoding for interleukin-1 and increasing severity of periodontitis.

PST® Genetic Susceptibility Test

Periodontal susceptibility test (PSTR) is the first and only genetic test that analyses two interleukins (IL-1α and IL-1β) genes for variations. The IL-1 genetic testing can be used to differentiate between IL-1 genotypes associated with diverse inflammatory responses to identify subjects at risk for severe periodontal disease even before the age of 60. Clinically, PSTR is used in("Periodontal Susceptibility Test (PST®):

New periodontal subjects to aid in the development treatment strategies.

To determine prognosis of subjects requiring extensive periodontal and/or implant therapy and to improve their acceptance and optimize the treatment outcomes.

As an incentive for smoking cessation.

Improvement of patient compliance and recall intervals in patients on maintenance.

Specialist referral after detection of early signs of the disease.[3]

4. Other Chair Side Tests

Periotemp

The Periotemp probe is a temperature sensitive probe, which reportedly detects early gingival changes by measuring temperature variations in these tissues. The periotemp probe detects pocket temperature differences of 0.1^0C from a referenced subgingival temperature. This probe has 2 light emitting diodes: red emitting diode which indicates higher temperature, denoting risk is twice as likely for future attachment loss; and green emitting diode, which indicates a lower temperature, indicting lower risk. However the presence of surface cooling caused by breath airflow may furthur complicate the determination of even a normal temperature distribution.[21]

Periotest

An electronic device originally developed by Schulte designed to measure the dampening effect or attenuation degree characteristics of the periodontium around natural teeth has been recommended to monitor the initial degrees of implant[22]. It develops a force of 12 to 18 N. A soft surface or a mobile object will give higher recordings than a hard or rigid object. The recordings range from negative (-8) to positive (+50) numbers. Teeth with zero clinical mobility have typical ranges +5 to +9. The degree of absence of movement can thus be valuated from -8 to + 9. (17 degrees)

However, differences in Periotest Values (PTV) have been reported for implants in the mandible and in the maxilla with implants in the maxilla showing higher PTVs. Despite some positive claims for this method, the prognostic accuracy of PTVs for the diagnosis of perimplantitis and early signs of implant failure has been criticized for the lack of resolution, poor sensitivity and susceptibility to operator variables.[14]

Perioscope

Perioscopy is a minimally invasive approach that was introduced in the year 2000. The perioscope is a miniature periodontal endoscope. When inserted into the periodontal pocket, it images the subgingival root surface, tooth surface, and calculus. Components of the perioscope include fiber-optic bundles bound by multiple illumination fibers, a light source, and an irrigation system. Perioscopic images can be viewed on a monitor in real time, captured, and saved in computer files. Although it causes minimal tissue trauma, perioscopy is not widely used, owing to its high cost and the need for a rigorous training period prior to use.[15]

Figure 4: Periotest

5. Kits Under Development

Beta-Glucoronidase

A diagnostic kit is being commercially developed by Abbot Laboratories, North Chicago, USA. It probably uses a histochemical substrate for the enzyme, coupled to a colour detection system which is released if the enzyme attacks the substrate.

Cysteine and serine proteinases

The test system suitable for chair side use has been developed by Enzyme System Products/Prototek of Dublin, California, USA. This firm synthesizes (AFC) which is more sensitive than other fluorogenic leaving groups. GCF is collected with chromatography filter paper strips. This has been applied to the detection of bacterial proteases in gingivalcrevicular fluid. A typical green fluorescence is produced which

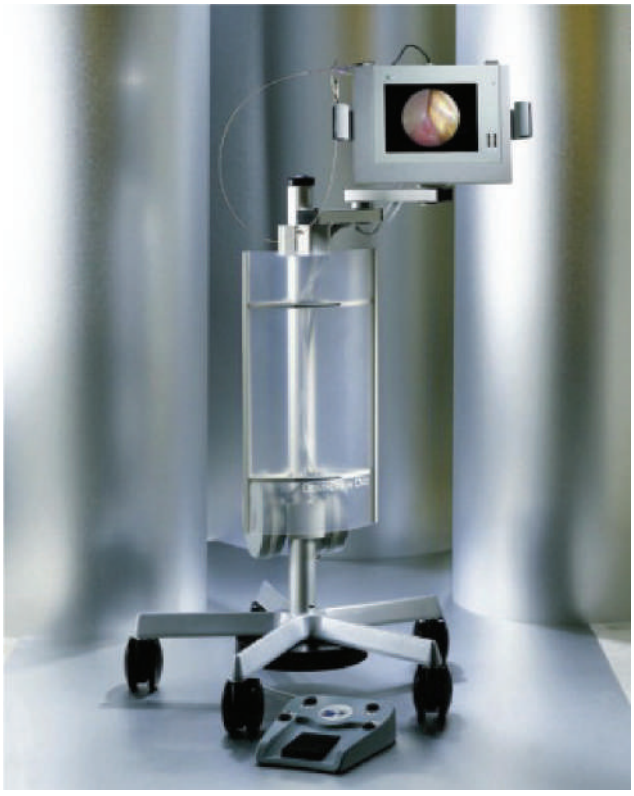

Figure 5 :Perioscope

can be detected by ultraviolet (UV) light. The amount of enzyme present is proportional to the intensity of the fluorescence or colour. The colour system is more sensitive than fluorescence and requires no special apparatus in the clinical setting.[3]

Conclusion

The accurate diagnosis marks the success of any treatment in periodontics. Hence most of us rely on advanced diagnostic methods rather than relying solely on clinical diagnosis nowadays. Apart from this, chair-side tests can improve patient compliance since these kits can be used for patient motivation. More emphasis on early detection of disease can offer minimally invasive and cost effective treatments for the patients.

Recently, lots of research works are under process which usesoral fluids as a medium for diagnostic purposes in various fields apart from dentistry. Since oral fluids are a promising biomarker which makes the prediction of periodontal diagnosis and their treatment outcomes inch-perfect.

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JSPIK

Alveolar Ridge Preservation And Reconstruction In Immediately Extracted Molar Using Bone Graft Material For Prosthetically Driven Implant Placement: A Case Report

Arunmozhi[1], Kadhiresan[2], Jenifer Cynthia[3], Shanmuga Priya[4], Indumathi[5]

ABSTRACT

Dental Implant therapy has become the most sought treatment modality in day-to-day dental practice for replacing missing tooth. Extraction of teeth due to dental caries, failed endodontic therapy, trauma, or periodontal disease results in alveolar bone resorption. Even when the patient prefers implants, it becomes challenging for the clinician to place implants in areas where there is inadequate width and height of alveolar bone. Placement of bone grafts in the extracted socket and covering with membrane have shown positive results in preserving the alveolar ridge. This case report is distinctive attempt made to preserve the socket using alloplastic bone graft material and resorbable collagen membrane for promoting bone regeneration and creating a proper platform for the placement of Implant.

Keywords: Alveolar ridge preservation, Bone grafts, Implants, bone resorption

Introduction

Unreplaced missing teeth plays a major role in individual esthetics and masticatory function. Difficulty or inability in chewing, not only leads to various systemic health conditions but also brings changes in diet and lifestyle. After normal tooth extraction, eventual bone resorption of 30-40% is expected to occur, and maximum level of ridge reduction occurs in first 3 months.[1] Resorption in mandible is four times greater than maxilla and this makes implant placement difficult in the posterior mandible.[2]

There are various treatment options available to replace missing teeth like removable/fixed partial denture and dental Implants. Even when a patient prefers an implant, there should be sufficient alveolar bone in volume and width. Insufficiency of volume and width leads to compromised treatment outcomes.

Alveolar ridge preservation is one such procedure developed to eliminate or limit the negative effect of post extraction resorption, to maintain the soft and hard tissue contour of the ridge, promote bone formation within the socket, and facilitate implant placement in a prosthetically driven position.[3]

Alveolar ridge preservation techniques are performed to minimize the loss of ridge volume and vertical height that occurs immediately after tooth extraction.

Case Report

A 43-year-old female patient, reported to the Department of Periodontology and Implant Dentistry, Sri Venkateswara Dental College & Hospital, Chennai, Tamil Nadu with the chief complaint of pain and loose teeth in the right lower back tooth region for the past 10 days. No relevant past medical history. The dental

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history revealed that, patient had undergone root canal treatment followed by Porcelain fused metal (PFM) crown in relation to 46 and 47. Intra-oral clinical examination showed, erythematous soft gingiva with a probing pocket depth of 7mm in the mid buccal region of 46,47. Also, both the teeth exhibited, grade II mobility and grade III Furcation involvement which were tender on percussion (Figure 1). Intra-oral periapical radiograph revealed radiopaque material in the coronal and root portion of 46,47 with cervical radiolucency and separation of roots at the level of CEJ. Vertical bone loss extending till the apical third of root along with peri-apical radiolucency was evident in 46, and bone loss extending till the furcation area was noticed in 47 (Figure 2).

Treatment Plan

Since both 46, 47 showed poor prognosis, extraction and replacement with Implant supported prosthesis was suggested to the patient. Intra-oral peri-apical radiographs in relation to 46,47 were taken and complete blood investigations were done to rule out any blood diathesis and any systemic illness. After obtaining a written consent from the patient, treatment planning was done to extract 46, 47 followed by degranulation and debridement of the socket. Placement of bone graft was also planned to preserve the existing alveolar ridge for future placement of the implant. Every month periodic re-checking and evaluation of the Implant site was planned. Implant placement was planned after 6 months depending upon the clinical and radiographic healing of the treated site.

Extraction

Under local anaesthesia, crowns were sectioned with metal burs and removed, then circumferential supracrestal fibrotomy (Pericision) was performed using B.P. blade no. 15 in 46, 47. Atraumatic extraction of the separated roots were done using Periotome[4] (Figure 3 & 4). Remnant granulation tissue present inside the socket was removed using area specific curettes. Disinfection of the extracted socket was done using 10 % betadine and saline in the ratio 1:1. Inspection of the extracted socket was done and according to the Extraction socket classification given by Salama and salama in 1993[5], the socket was classified as Class II extracted socket. Then the socket was grafted with alloplastic bone material Ostin ® of particle size 0.355mm

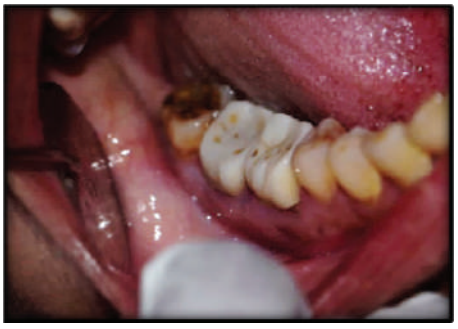

Figure 1 : Pre-operative view

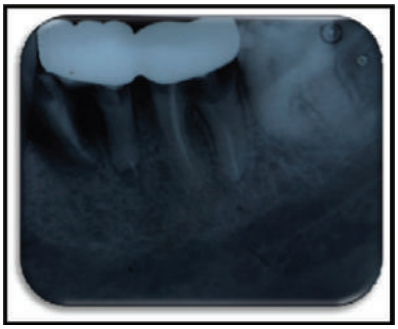

Figure 2 : Pre-operative IOPA

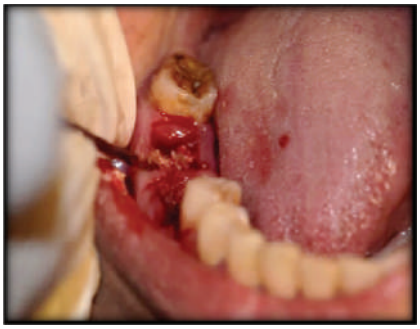

Figure 3 : Atraumatic extraction

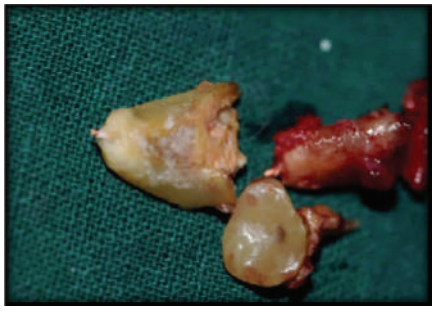

Figure 4 : Extracted roots

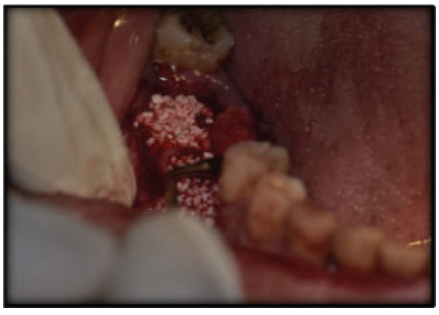

Figure 5 : Bone graft placement after curettage

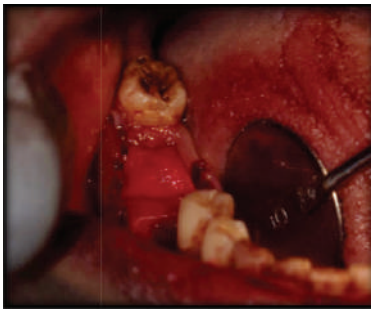

Figure 6 : Membrane adaptation

to 0.500mm, Basic Healthcare, India (Figure 5).

The extracted site and the bone graft were covered with artificial collagen membrane Cologide™ with a dimension of 20mmx32mm (closed socket technique), (Figure 6), and the surgical site was sutured with non-absorbable silk material (Figure 7) and non-eugenol periodontal dressing (Coe-pak®) was given. Post-operative instructions were given and the following medications were prescribed (Cap. Amox 500mg b.i.d. for five days, Tab. Flagyl 400 mg b.i.d. for five days, Tab.Zerodol-P twice b.i.d. for five days after food and Tab. Pan 40 mg o.d. 30 mins before breakfast)

Post- operative review was done on the third day, patient was comfortable with no pain or swelling. Suture removal was done after 1week; periodic assessment was planned for every month and Implant placement was planned after 6 months

Implant Placement

After a period of 6 months, patient was re-evaluated clinically and radiographically, which revealed healthy tissue and an adequate bone fill in relation to 46, 47 (Figure 8). Clinically bone fill was measured using bone caliper and periodontal probe and it showed adequate width. Radiographs showed very good bone fill in the socket and as well as adequate height for the placement of Implants in relation to 46,47.

Under Local anaesthesia, crestal incision was placed in relation to 46,47 using BP blade no.15. Full thickness muco-periosteal flap was elevated on both buccal and lingual aspects. Osteotomy sites were marked using round bur and pilot drill (2.0mm) used to drill the surgical site. Sequential enlargement done using 2.75, 3.25, 3.75mm drills. Two Implants (Norris) of size 4.2 x 11.5mm (Figure 9 & 10) were placed and surgical site closed with non-absorbable silk sutures. Post-operative instructions were given and the following medications were prescribed (Cap. Amox 500mg b.i.d. for five days, Tab. Flagyl 400 mg b.i.d. for five days, Tab.Zerodol-P twice b.i.d. for five days after food and Tab. Pan 40 mg o.d. 30 mins before breakfast)

Post-operative review done after 1 week and the sutures were removed. Post-operative radiograph showed good healing and parallelism between the implants. After 8 months screw retained ceramic crowns were delivered in relation to 46,47 (Figure 11&12) and follow up done (Figure 13).

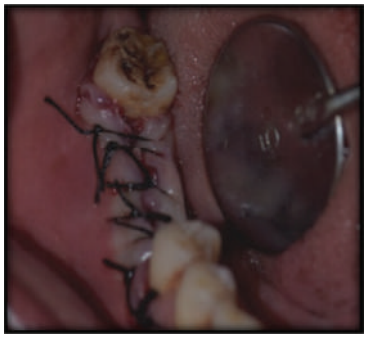

Figure 7 : Suturing of surgical site

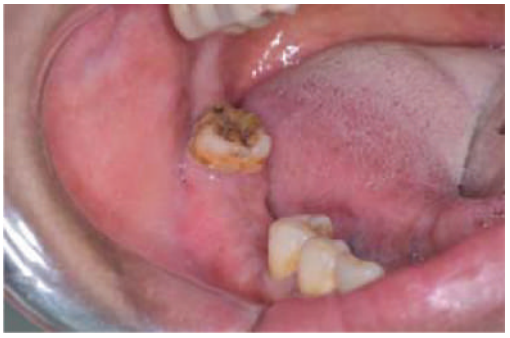

Figure 8 : Post-operative (6 months) showing adequate ridge width and height

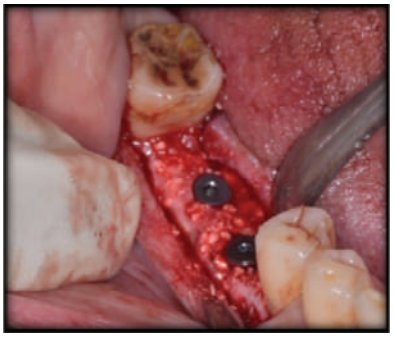

Figure 9 : Implant placement

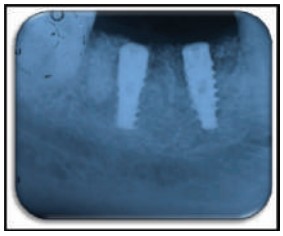

Figure 10 : IOPA after Implant placement

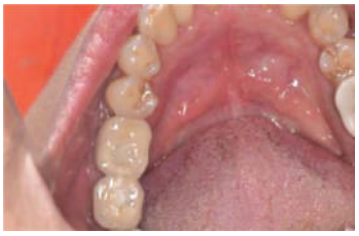

Figure 11 : Post Implant prosthesis done in relation to 46,47 (Mirror image)

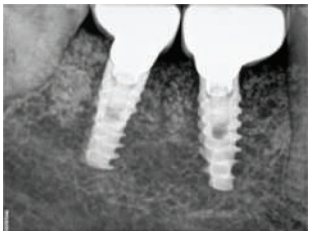

Figure 12 : IOPA showing Implant final restoration

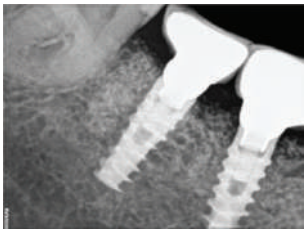

Figure 13 : IOPA showing Implant restoration after 6 months

Discussion

Following normal tooth extraction, there will be reduction in alveolar bone height and width (remodelling) which is inevitable and considered a normal physiologic process. Alveolar ridge resorption has a significant influence on replacing a missing tooth and thus preserving the alveolar ridge height and width becomes very essential for successful implant placement in the future.

The benefits of Alveolar ridge preservation techniques have been supported in various studies in the past literature. Iasella[6] et al. (2003), in their randomised controlled clinical & histological human study done with 24 patients, assessed the alveolar ridge dimensional changes between extracted socket with no preservation, and ridge preservation using freeze-dried bone allograft and collagen membrane. Their results showed a decrease in the ridge width from 9.1 ± 1.0 mm to 6.4 ± 2.2 mm (extraction group), whereas it was 9.2 ± 1.2 mm to 8.0 ± 1.4 mm (ridge preservation group). Approximately 1.6mm of width preservation was seen after the placement of graft and membrane, and in terms of height preservation it was approximately 2.2 mm.

Alveolar ridge preservation through socket grafting came to light in the mid-1980s. This technique consists of atraumatic extraction of the fractured or decayed tooth along with placement of bone grafts within the socket and covering the wound area by a membrane.

The following sequence of events occurs within the socket after extraction; initially the socket is filled with blood from the blood vessels supplying that area. Then there will be a formation of fibrin network and the platelets combines with the fibrin meshwork resulting in formation of blood clot or coagulum within 24 hours. These blood clot acts as a matrix which helps in movement of the cells and the growth factors for better healing. Later neutrophils and macrophages enter through the wound. These neutrophils engulf and phagocytise the bacteria further sterilizing the wound. Fibrolysis of the blood clot succeeded by the formation of a granulation tissue occurs within 4 days. New vascular network will form and the extracted socket is covered by connective tissue and inflammatory cells. After a period of 4-6 weeks, fresh woven bone will form which later turn it lamellar bone in a period of 4-6months.[7]

Whereas when the extracted socket is filled with graft particles covered by a membrane (Guided bone regeneration), In less than 24 hours after the placement of the grafts, the space created by the barrier membrane is filled with blood clot and form a fibrin meshwork. This fibrin network encircles the graft particles and inflammatory process is initiated. Large number of polymorphonuclear cells and osteoclastic cells move towards the surface of the graft particles removing small amounts of graft material. In next 2 weeks, osteoclasts are replaced by osteoblasts and there is periodic apposition of osteoid. After 2 weeks, immature, newly formed trabecular bone is seen predominantly on the apical and lateral region of the socket.[8] Thus the graft material acts as a solid scaffold aiding in stabilization of the clot,9and the barrier membrane helps in preventing the down growth of the oral epithelium.

This is supported by a systematic review done by Ten Heggeler[10] et al in 2011, to evaluate the benefits of post-extraction alveolar ridge preservation procedures by using bone fillers, collagen, growth factors or membranes in non-molar tooth region compared with natural healing without any addition of grafts. It was concluded that in natural healing group, there was a decrease in alveolar width approximately from 2.6mm to 4.56 mm and height from 0.4mm to 3.9mm when compared with the graft group.

Over the years, many studies were done to assess the effectiveness of various graft & biomaterials used in filling the socket. Darby et al in 2009 reviewed various graft materials used for preserving the socket. Graft used for ARP can be autogenous grafts, bone substitutes (allografts, xenografts or alloplasts), autologous blood-derived products, bioactive agents or a combination of the above mentioned.[11] For obtaining best outcome, all graft material require an adequate vascularity, mechanical stability, and osteogenic cells supplied by the host, graft material, or both.

Alveolar ridge preservation with graft and membrane are considered ideal for future placement of Implant. This is supported by a Human study done

by Horowitzet al in 2009, beta tricalcium phosphate alloplastic material was used following tooth extraction to fill the socket and for preserving the ridge volume prior to implant placement, it was concluded that the width of the extraction sockets were preserved was up to 91% of the preoperative width.[12] They further concluded that extraction socket grafting with the beta-TCP and covering the filled area with a resorbable collagen membrane was a reliable method for preserving alveolar dimensions.

Likewise in a clinical and histologic study done on humans by Cardaropoli et alin 2008, theyevaluated the likelihood of preserving the buccal and lingual plates following extraction from getting resorbed using osteoconductive bone filler concealed by collagen membrane.[13] The results showed that approximately 85% of the initial ridge dimensions were preserved providing a good base for ideal Implant placement. Also, histologically osteogenesis was observed in almost all the sites grafted.

In 2012 Ren E. Wang & Niklaus P. Lang et al performed ridge preservation procedures in humans and concluded that immediate dental implants placement following tooth extraction did not halt the alveolar bone resorption. Also socket preservation with bone grafts along with collagen membrane abiding with guided bone regeneration principles showed better results in preserving ridge width and height.[14]

Therefore, In our case report, Synthetic bone graft material have been used because of its volume of availability, good osseo-conductive, osseo- inductive properties[15] and It also acts as an excellent platform for new bone formation within the socket. Also, covering the surgical site with resorbable collagen membrane had an added advantage by promoting good haemostasis; complete sealing of the socket, better adaptability and it was simple to use.[16]

Conclusion

Implant restoration is becoming a trend in day-to-day dental practice. Healing period of 3-6 months will be ideal for augmented or preserved sockets to gain a better alveolar ridge height and width. When compared with non-grafted site, Preserved alveolar ridge will serve as a better platform for implant placement. Advantages of Alveolar ridge preservation includes, faster healing, better stability, and good patient compliance for long term.

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JSPIK

Lateral Periodontal Cyst in Endodontically-treated Teeth: A Rare Case with Common Misdiagnosis

Najia Nazir[1], Anil Melath[2], Prem Sasikumar[3], Subair K[4]

ABSTRACT

Lateral Periodontal cyst (LPC) is an uncommon and unusual developmental odontogenic cyst. It presents as a well-circumscribed round or tear-shaped radiolucent area, commonly seen in mandibular canine-premolar area or maxillary anterior regions, associated with vital teeth. Histopathological analysis is mandatory for final diagnosis. This article aims to report a case of LPC seen on an endodontically treated mandibular premolar. A 40-year old female patient reported with a chief complaint of an asymptomatic swelling in right lower posterior region of the jaw. Radiographic investigation revealed a well circumscribed circular lesion of approximately 8 mm diameter adjacent to an endodontically treated right mandibular second premolar. A total enucleation and histopathological analysis was done confirming the diagnosis of "lateral periodontal cyst".

Keywords: Cyst of Jaw, Lateral periodontal cysts, Odontogenic cyst

Introduction

Lateral periodontal cysts (LPCs) are non-keratinized and non-inflammatory developmental cysts. With a rare prevalence rate of about 0.8%, it is a harmless, incidental finding, frequently located near mandibular canine-premolar region or maxillary anteriors.[1]

LPCs are commonly related to vital teeth, hence there is a difficulty in its diagnosis in endodontically treated teeth. A careful analysis and co-relation of clinical, radiographical and histopathological analysis will help in accurate diagnosis of the lesion. Here, we report a rare case of lateral periodontal cyst involving an endodontically-treated mandibular premolar and a brief review of literature regarding its unique features.

Case History

A 40-year-old female patient was referred to the department of Periodontics with a chief complaint of asymptomatic swelling in the lower right posterior region of the jaw. The patient had undergone endodontic root canal therapy for the right mandibular second premolar (45) a year back. A PFM crown was placed for the same. The patient was concerned about the swelling for which a re-root canal treatment was advocated by a previous clinician. No systemic comorbidities were reported.

Intraoral examination revealed a solitary swelling measuring approximately 8 mm in diameter adjacent 45 and 46 region extending from the attached gingival to the buccal vestibule (Figure 1). Mesiodistally, the swelling extends from mesial surface of 45 to distal surface of 46. The swelling presented with well-defined margin and the mucosa appeared normal. On palpation, the swelling was non-tender and non-fluctuant. No exudates were noticed through the swelling or the gingival sulcus.

The imaging examination (panoramic radiography and cone-beam computed tomography) revealed

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scooped out, concave spheroidal lesion of size 7.77 mm x 6.31 mm x 3.1 mm, noted buccally overlying the root of 45, and extending from distal aspect of 44 till mesial aspect of 46. Subsequent perforation of buccal cortical plate and exposure of root noted, extending from alveolar crest till 6.13 mm below the CEJ (middle-third of root). Lesion continued without perforation buccally till the apical third of root. Lingual cortical plate was unaffected. Obturation extended till root apex without any obvious voids. No evidence of lateral/accessory canals, root fractures, internal or external resorption or ankylosis was reported (Figure 2 & 3).

Based on clinical and radiographic features, a provisional diagnosis of lateral periodontal cyst was concluded. Following this, the patient was referred to the Department of Oral and Maxillofacial Surgery where cyst enucleation as a treatment option was planned. Under local anesthesia, mucoperiosteal flap elevation was done in relation to 45 & 46, using crevicular incisions (Figure 4). The cystic lesion was identified and blunt dissection was done using surgical curette to excise the cyst in total (Figure 5 & 6), without compromising its intergrity. The site was irrigated with sterile normal saline solution and the flap was sutured back using 3-0 silk suture (Figure 7). Patient was prescribed antibiotics and analgesics and post-surgical instructions were given. Patient was recalled after a week for suture removal. The post-operative healing was uneventful.

The histopathological examination revealed cystic lining consisting of thin epithelium or two or more cuboidal cells and occasional focal thickening. Occasional clear cells were seen and scanty inflammatory cells were present (Figure 8).

The clinico-radographic and histopathological analysis confirmed the diagnosis of lateral periodontal cyst. Patient was followed up after 6 months wherein no recurrence was noted (Figure 9, 10).

Discussion

Standish and Shafer first described LPCs in 1958. Wysocki et al, in 1973, described LPCs as an intrabony representation of gingival cyst of adults.[2] Botyroid odontogenic cyst, an unusual form of LPCs, was

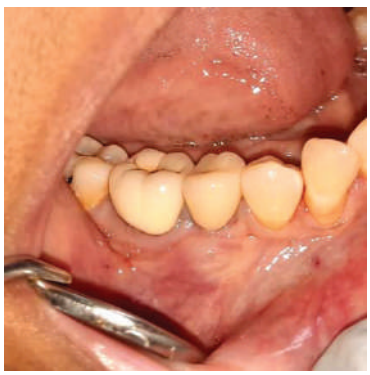

Figure 1: Pre-operative site presenting swelling irt 45.

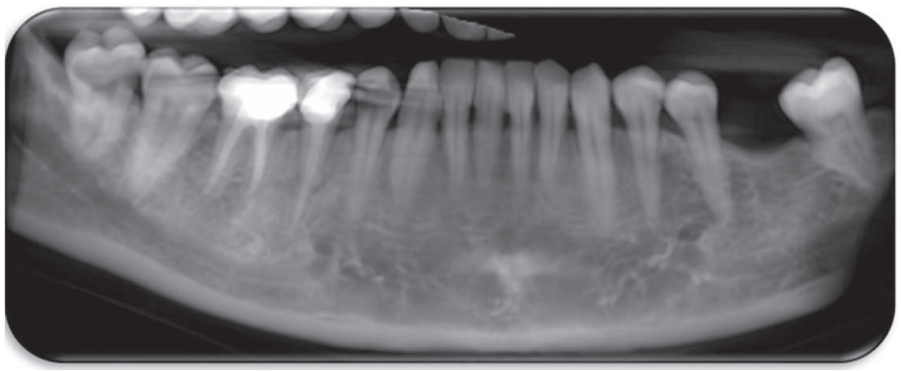

Figure 2: Pre-operative OPG

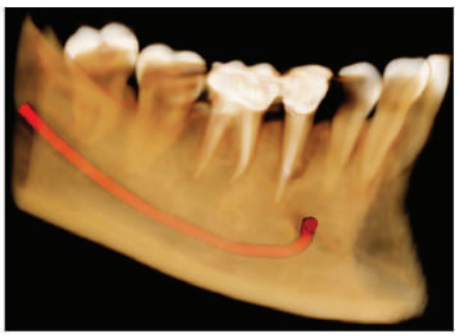

Figure 3: Pre-operative CBCT

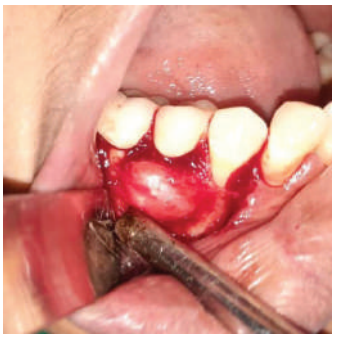

Figure 4: Mucoperiosteal flap elevation

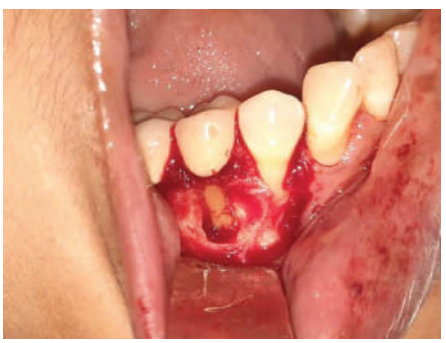

Figure 5: Operative site after cyst removal

reported by Weather and Waldron in the same year as a polycystic variant of LPC formed due to fusion of adjacent multiple LPCs.[3] LPCs are rare odontogenic cysts which are more prevalent in adults in the 5th-7th decades of life (mean age of 52 years), without and racial or gender predilection. It is frequently associated with vital teeth in the mandibular premolar region, followed by maxilla anterior region without presenting any distinctive symptoms; occasionally secondarily infected.[1] The present case reveals a rare instance in which LPC was associated with endodontically treated teeth. Maciel-Santos et al.[4] reported a botyroid-variant of LPC associated with non-vital teeth. LPCs can be classified as unicystic, multicystic, or botryoid variants, but all of them with similar histopathological presentation.[5] The botryoid cyst presents a histopathological variant with multilocular cystic "grapelike" appearance in the bone.

The diagnosis of LPC is based on the clinical, radiographic and histopathological examination, which is important to differentiate it from other cystic lesions of the jaws, namely inflammatory cysts and odontogenic keratocysts. Though the present case is associated with endodontically treated teeth, the CBCT report shows no discrepancies in the obturation and absence of lateral infected canal, root resorption and tooth fracture, ruling out the possibility of an infected cyst. It is imperative to confirm the diagnosis with histopathological examination which is characterized by a cystic lining of thin nonkeratinized squamous epithelium, 1-3 cell layers thick, along with epithelium plaques and glycogen-rich clear cells. Inflammatory cells are rarely observed, unless secondarily infected.6All these features are prevalent in the present case.

Management of LPC involves total enucleation of the cyst and curettage of the cystic cavity to ensure elimination of remnants. This should be done meticulously, without injuring the adjacent teeth. Reconstruction of the cystic cavity should be carried out by using guided tissue regeneration for long-term maintenance of periodontal health, especially in cases of multilocular botyroid-variants.[7] Recurrence rate of LPC is low (3-4%), except for botyroid cysts (30%).8 These cysts develop from pre-existing LPC lining and

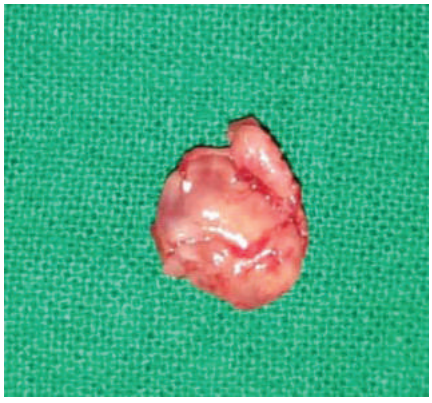

Figure 6: Enucleated cyst

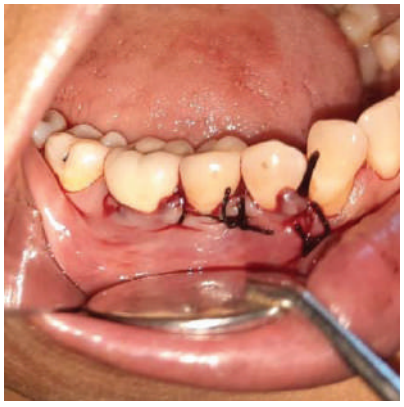

Figure 7: Suturing done

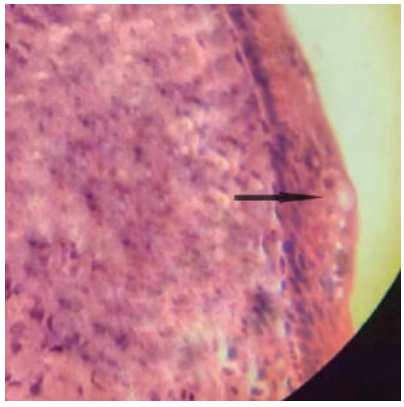

Figure 8: Histopathological examination

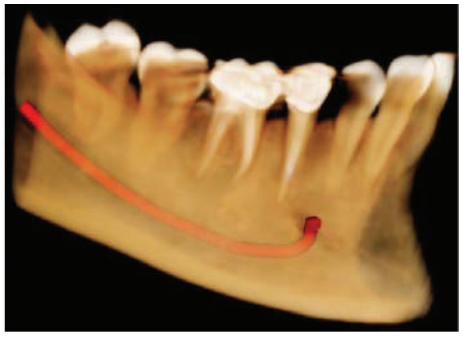

Figure 9: OPG- 6 months follow-up

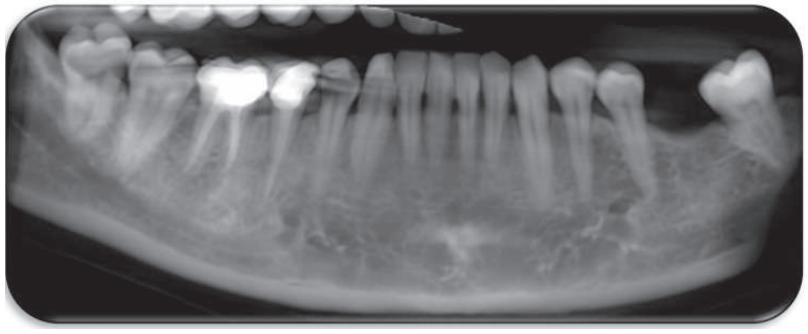

Figure 10: CBCT- 6 months follow-up

have aggressive expansion as seen in a case reported by Nart et al. In such cases, it is imperative to have a follow-up regimen of 3 months to monitor the periodontal health status and recurrence of cystic lesion.[9]

Conclusion

LPC is an uncommon odontogenic cyst usually associated with asymptomatic vital teeth. This case presents a rare instance where LPC was associated with endodontically treated teeth, which can be misdiagnosed as an inflammatory cystic lesion. A careful diagnosis co-relating the clinical, radiological, as well as the histopathological examination is imperative for the proper management of the cystic lesion.

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JSPIK

Mesiobuccal Root Resection of Maxillary First Molar: Case Report and Review

Steffi Vijayakumar[1], Arun Sadasivan[2]

ABSTRACT

Root resection is the process by which one or more of the roots of teeth are removed at the level of furcation while leaving the crown and remaining roots in function. Indications of root resection therapy include the teeth with periodontal problems, endodontic problems, root fractures and prosthetic problems. Root resection is very technique sensitive and complex process in which proper case selection is essential. A 42-year-old male patient reported to the department of Periodontology with a chief complaint of pain in relation to upper left back tooth. On examination the mesiobuccal root of left maxillary first molar showed severe bone loss, recession, probing depth and clinical attachment loss. The tooth was non-vital and diagnosed as primary periodontal and secondary endodontic lesion. The root canal treatment was done. The mesiobuccal root was resected and subsequently following healing temporization was done and after six months full ceramic crown was cemented.

Keywords: mesiobuccal root, root resection,full ceramic crown

Introduction:

The goal of periodontal therapy is to provide a dentition with health. Root resectiveprocedures can help in conserving the remaining natural tooth structure. The tooth can be retained in part or entirety to serve as strategic abutment tooth in fixed dentures or as a single unit fixed prosthesis thereby improving the masticatory efficiency. The American Academy of Periodontology defined root resection as a process by which one or more of the roots of a tooth are removed at the level of furcation while leaving the crown and remaining roots in function.[1] Root resection (also known as radisection or root amputation) can be distinguished from crown resection procedure, by the former being defined as a process including amputation at the level of the cementoenamel junction with intact coronal portion. On the other hand, "crown resection" includes hemisection, trisection, or bicuspidization of the crown in a multirooted tooth, which is traversed through the furcation in a way that both the root and the associated portion of the crown may be removed or retained.

Farrar introduced root resection procedure, which has been used to treat Class II and Class III furcation involved molar[2]. Dr. W J. Younger in 1894 had also addressed the gathering of the American Medical Association and explained his opinion of root amputation procedure in hopelessly involved roots of molar teeth that can be made comfortable and serviceable for years. Coolidge in 1930 and Sommer in 2002 emphasized the importance of eradication of microorganisms by proper preparation and sealing of the root canal before beginning the root resection. Contributions made by Hiat and Amen were highlighting the indications and procedures for root amputation in the 1960s, which were put to practicality by Farshchian and

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Kaiser by implementing bicuspidization procedure in managing teeth with severe furcation involvement.[3,4] Through root resection therapy furcation involved molar is converted into non-furcated single root teeth and provide a favourable environment for oral hygiene.

Indications of root resection:[5,6,7]

Periodontal indications:

- Severe vertical bone loss involving only one root of multi-rooted teeth.
- Through and through furcation destruction.
- Unfavorable proximity of roots of adjacent teeth, preventing adequate hygiene maintenance inproximal areas.
- Severe root exposure due to dehiscence.

Endodontic and restorative indications

- Prosthetic failure of abutments within a splint: lf a single or multirooted tooth is periodontally involved within a fixed bridge, instead of removing the entire bridge, if the remaining abutment support is sufficient, the root of the involved tooth is extracted.
- Endodontic failure: Hemisection is useful in cases in which there is perforation through the floor of pulp chamber or pulp canal of one of the roots or an endodontically involved tooth which cannot be instrumented.
- Vertical fracture of one root: The prognosis of vertical fracture is hopeless. If vertical fracture traverses one root while the other roots are unaffected, the offending root may be amputed.
- Severe destructive process: This may occur as a result of furcation, sub gingival caries, traumatic injury and large root perforation during endodontic therapy.

Contraindications

- Strong adjacent teeth available for bridge abutments as alternatives to hemisection.
- Inoperable canals in root to be retained.
- Root fusion making separation impossible.

Factors considered to retain the root :

Factors affecting root selection for amputation

1. The amount of remaining bone support.
2. Accessibility for plaque removal.
3. Root proximity.
4. Position of the root in the arch.
5. Root morphology.
6. Endodontic complications.
7. Comparable bone loss around the roots.
8. Endodontic and prosthetic considerations should be the determining factor.

Occlusal considerations[8]

- Diminished bone support and less favourable crown: root ratio.
- Occlusal narrowing should be accomplished.
- Centric contacts should be established with the opposing teeth.
- Forces should be directed in an apical direction along the axis of the tooth.
- Functioning lateral working excursions should be eliminated.
- Balancing or non-functioning contacts should not exist.
- Occlusal narrowing is accomplished by reducing the lingual cusps of mandibular teeth and thebuccal cusps of maxillary teeth.

Endodontic considerations[9]

Vital root resection

In situations when root resection is confirmed at the time of surgery, endodontic treatment is performed days after surgery. Immediately following root resection, the exposed remaining roots are dressed with Zinc oxide eugenol or calcium hydroxide paste. Today there appears to be consensus to proceed with root canal therapy no longer than two weeks following resection.

Non- vital root resection based on the assumptions that

In acute pulpitis, exacerbation of chronic pulpitis (as in the case of severe periodontal involvement) interference with periodontal wound healing by the

inflamed pulp.

Severe contamination of the pulp during amputation can develop. Today therapeutic approaches recommend endodontic treatment prior to root resection

Case Report

A 42-year-old male patient reported to the department of Periodontology with a chief complaint of pain in relation to upper left back tooth. Medical history was non-contributory. On clinical examination,gingiva shows soft and edematous, bleeds spontaneously on mesial side of 26. Periodontal examination shows Class III gingival recession, probing pocket depth of 6mm on mesial side, clinical attachment loss of 9mm and Grade II furcation. Tooth was non-vital [Electric pulptester, DIGITEST, PARKELL, USA]. A diagnosis of primary periodontal and secondary endodontic lesion was made. Root canal treatment was done. After re-evaluation, mesiobuccal root amputation was planned. A full thickness flap was raised (2% Lignocaine hydrochloride with 1:100000 adrenaline). Thorough debridement was done. Mesiobuccal root was resected with tapered diamond bur. The flap was then repositioned and sutured with 3-0 black silk sutures. Sufficient care was taken to gain soft tissue closure and to facilitate accessible maintenance of good oral hygiene. Amoxicillin 500 mg t.i.d for five days and Diclofenac sodium 50 mg for three days were prescribed. Chlorhexidine gluconate mouthwash 0.2% 10 ml b.d. was prescribed for one week. Temporization

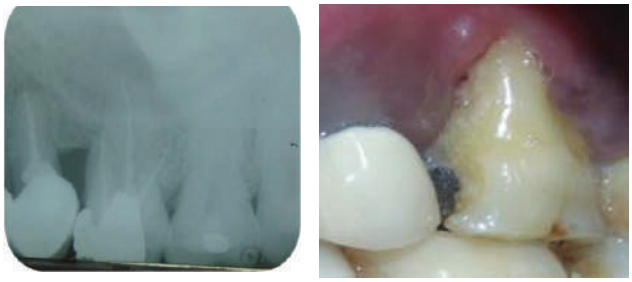

Fig-1.Pre- operative view

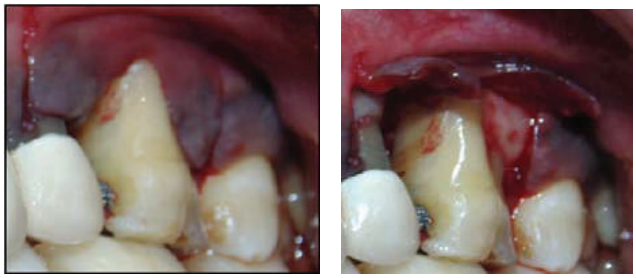

Fig-2. Incision given and flap reflected

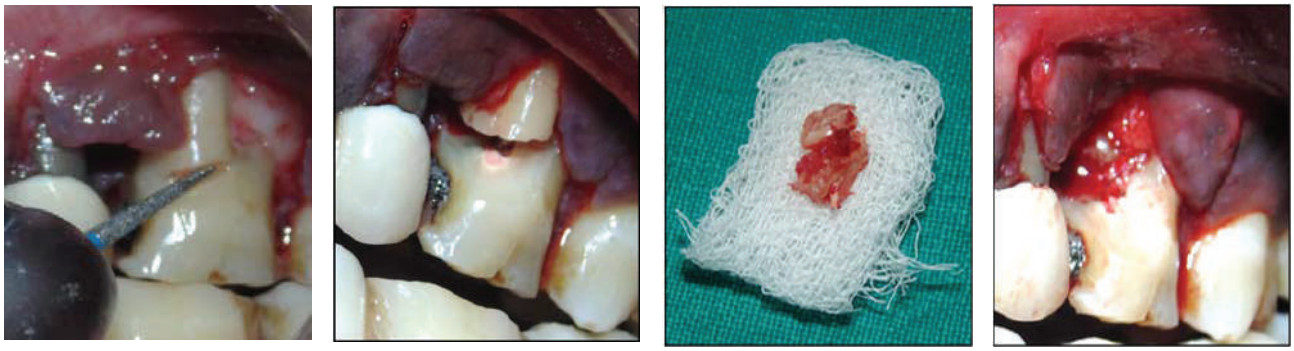

Fig-3. Mesiobuccal root resection of 26

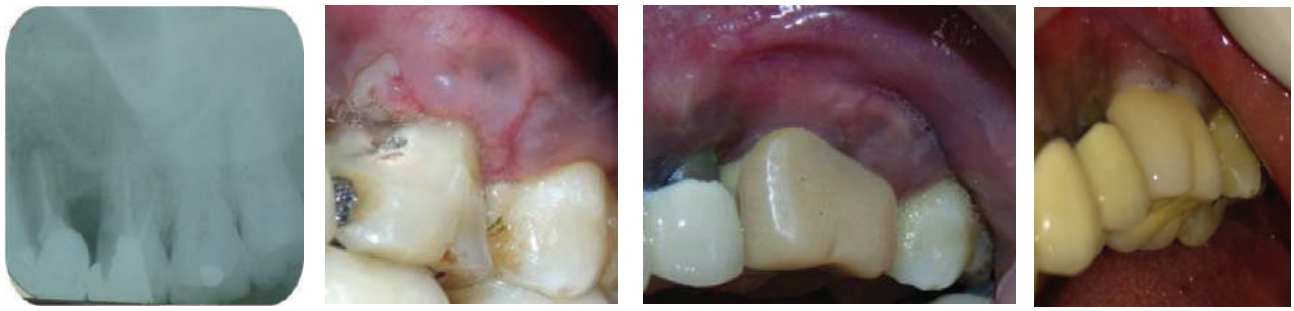

Fig-4. Post-Operative View

Fig-5. Temporary crown placed and replaced by full ceramic crown

was done within one month. Full ceramic crown was placed as per patient's request after 6 months.

Discussion:

Root resection has been used successfully to retain teeth with furcation involvement. Successful root-resection therapy requires a careful multidisciplinary approach including periodontal surgery, endodontic treatment, prosthetic reconstruction, and oral hygiene maintenance. Nadim Mokbel et al. in a systematic review observed that the root resection and hemisection are associated with high survival rates, making it a reliable option for treatment of furcated molars that should be considered before every extraction and implant placement[10]. The disadvantages associated with this procedure are pain and anxiety of a surgical procedure and susceptibility of the root surface area to caries. Failure of endodontic therapy due to any reason will cause failure of the procedure; progressive periodontal destruction and improper prosthesis design can lead to trauma from occlusion. Muzzi et al. suggested that the probability of tooth loss increased with a decreasing residual amount of supporting bone[11]. Although extraction and tooth replacement with implant was another treatment option, it was deferred because of the patient's financial constraints. In this case root resection is preferred after endodontic treatment. The mesiobuccal root is resected because of poor bone support and the tooth is replaced with full ceramic crown. The restoration of resected molars should take into account the distribution of occlusal loads , and the remaining roots should carry the lightest loads possible[12]. Setzer et al. in a systematic review and meta-analysis reported five studies of root resection performed on the maxillary arch, in which data extraction regarding specific procedures showed an overall success rate of 97.8% in cases with a follow-up of more than 12 months[13]. A 15-year follow-up study done by Fugazzotto reported a success rate of 97.6% for root resected maxillary first molars when compared to Langer et al1[4,12]. who reported 84% failure rate in molars after a period of 5 years. This discrepancy reported was due to random selection of cases in the latter study without proper follow-up, thereby failing to assess the quality of periodontal and endodontic therapy after root resection as well as ignoring the aspect of functional loading and unloading in such cases[14]. Hence, root resection is a technique-sensitive procedure and should be attempted only after contemplating the prognosis of the tooth to be operated with a thorough follow-up.

Conclusion:

Root resection involves multidisciplinary approach. It is one of the treatment options for preserving molars with furcation involvement. The success of this procedure depends on careful case selection and appropriate treatment planning. Moreover, long-term follow-up of root resection cases is necessary so as to validate them as a successful treatment option.

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