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President's message

I am much obliged to the Society of Periodontists and Implantologists of Kerala, for supporting me as President of this distinguished group of doctors. Our SPIK has completed 15 successful years and has played a key role in guiding and promoting its members. As one of its founder members, I am very pleased with the growth that SPIK has achieved.

We have a variety of programs planned for this year. A webinar was organized on July 15, 2022, the first scientific program of this association year. This was followed by celebration of Oral Hygiene Day on August 1,2022, where we organized a walkathon in collaboration with the Indian Dental Association Thiruvananthapuram Branch. Also, in collaboration with PMS College of Dental Science & Research Thiruvananthapuram, a flash mob program was conducted at Lulu Mall Thiruvananthapuram for the public on the importance of oral hygiene. An oral hygiene awareness event at Poojappura Central Jail, Thiruvananthapuram and an e-poster presentation competition for undergraduate and postgraduate students were also held as part of the Oral Hygiene Day celebrations.

Among the new proposals for post graduate students in this association year is a one-day online orientation program for first year MDS students on postgraduate education - expectations, documentations, etc. The second orientation program is about the dissertation - choosing a topic, writing a synopsis, and preparing the manuscript. We plan to organize this year's Midterm Conference in Thiruvananthapuram as a two-day program between October and December. An essay competition will be conducted online for final BDS part I students, interns, post graduate students and general practitioners of Kerala. Also, the SPIK Periodontology Scholarship Examination will be held at the Amrita School of Dentistry in Kochi. Another event is a CDE program in collaboration with IDA Malabar Branch for SPIK members, IDA members and post graduate students. And finally, the annual conference will be held at Kannur Dental College, Anjarakandy.

Our journal JSPIK is now in its 16th year of publishing. I would like to congratulate our editor Dr. Shahana and thank her for her excellent work. Our members will be able to update their knowledge in scientific fields through our journal. I request you all and your colleagues to contribute articles to JSPIK and also to log onto our website for updates and news of our society.

My sincere thanks to our Secretary SPIK Dr. Mohammed Feroz who has made my job easier, the Scientific Program Convenor Dr. Sameera, Periodontal Health Care Convenor Dr. Manikandan, Website Convenor Dr. Tony Kurian, all the executive members and SPIK members who constantly support me in all activities.

As members of the SPIK family, I humbly ask you all to continue to support SPIK and me so that we can work together and contribute to the improvement and advancement of this society.

Dr. Presanthila Janam
President, SPIK

Secretary's Message

Dear SPIK members,

I welcome you all to the first issue of our journal "JSPIK" in this SPIK year!

Let me begin by thanking and acknowledging the meritorious contributions of the senior members, past presidents, and our dedicated and active office bearers for the overall development of our society. The installation of the new office bearers took place in conjunction with the fourteenth annual conference. Our Association is slowly recovering from the unforeseen Covid pandemic and has begun its activities with a webinar and then continued with the Oral Hygiene Day celebration and now with the upcoming Midterm conference. Congratulations to Dr Manikandan, Periodontal Health Convenor, who did an exemplary job of coordinating the Oral Hygiene Day celebration.

We would like to attract more members to strengthen our society. Your creative ideas, positive suggestions and healthy criticism will definitely improve our SPIK activities.

We look forward to your continued support.

Dr Mohammed Feroz T P
Secretary, SPIK

INFORMATION TO AUTHORS

About the Journal

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Preprocedural Mouthrinse: An Evidence Based Review

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ABSTRACT

During dental procedures like scaling, tooth extraction, periodontal surgeries, root canal therapy, etc, bacteria and their components, such as endotoxin, can easily disseminate into the systemic circulation through minor or major gingival injuries. The presence of bacteria in blood has been defined as bacteraemia. Even physiological processes like mastication and oral hygiene measures like tooth brushing, gingival massage or use of oral irrigation devices can also lead to bacteraemia especially through inflamed gingiva. In immuno-compromised subjects or patients with pre-existing pathologic conditions, bacteraemia may lead to bacterial infection of distant organs, which may lead to serious complications. Oral bacteria and endotoxins have been found in sepsis, infective endocarditis, lung infection, liver disease and many other potentially lethal disorders.

The use of antiseptic pre procedural mouthrinses has been shown to be effective in reducing bacteraemia and microbial counts in the oral cavity. Thus, the number of microorganisms in the dental aerosol will also be reduced which may decrease the risk of contamination and cross infection in the dental office. Many agents have been used as preprocedural mouthrinses including chlorhexidine, cetylpyridinium chloride, phenols and essential oils, povidone-iodine, hydrogen peroxide and herbal agents such as aloe vera because of their antimicrobial properties.

The need of preprocedural mouthrinses have increased in the recent years due to emergence of global coronavirus disease pandemic. The use of preprocedural mouthrinses has shown to reduce the viral load in saliva and oropharyngeal tissues, thus decreasing viral load in dental aerosol. This evidence-based review is an update on research carried out on the use of preprocedural mouthrinses.

Keywords: Pre-procedural mouthrinse, aerosol, bacteraemia, chlorhexidine, povidone-iodine, essential oils, aloe vera

Introduction

Dental operatory poses a riskier environment with possibility of cross-infection between dentists and patients due to high quantity of contaminated aerosol produced by the standard clinical procedures inside the oral cavity where many type of microorganisms may be found. Microbes may be present in the saliva, dental plaque and other oral tissues and dental procedures which use high-speed turbines, air–water syringes, ultrasonic instruments and lasers generate contaminated spray, spatter and aerosols and may spread a considerable load of these microorganisms in the air, which may also be inhaled or transmitted via direct contact with conjunctival, nasal, or oral mucosa of both oral health care personnel and patient.[1]

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The use of antiseptic pre procedural mouth rinses has been shown to be effective in reducing microbial counts in the oral cavity. As a result, preprocedural mouth rinses are used to decrease the number of microorganisms in the dental aerosol, which may help reduce the risk of experiencing contamination in the dental office. Many agents have been used as preprocedural mouth rinses including chlorhexidine (CHX), cetylpyridinium chloride (CPC), phenols and essential oils (EO), povidone-iodine (PVP-I) and herbal agents such as aloe vera (AV) because of their antimicrobial properties. Another important indication for preprocedural mouth rinsing is to reduce bacteraemia produced during dental procedures. Bacteraemia is a condition where viable bacteria are present in the bloodstream of an individual. Bacteraemia frequently occurs after dental treatment procedures such as extractions, scaling, periodontal probing, suture removal, orthodontic treatment, restorative dentistry and non-surgical root canal treatment. Most of such bacteraemia are transient. It has long been recognized that oral bacteria may even cause distant site infections. (Figure 1)

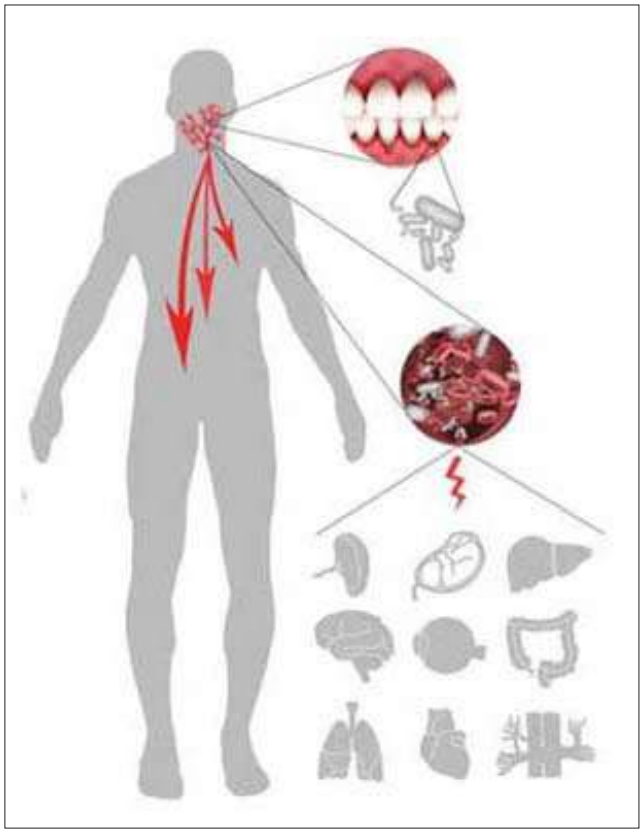

Figure 1: Effect of Bacteraemia in systemic circulation

Bacteraemia with oral bacteria also may play a role in the pathogenesis of atherosclerosis. Several studies have demonstrated the presence of certain oral bacteria in atherosclerotic plaques and abdominal aortic aneurysms, in particular species that have been implicated in the pathogenesis of periodontal disease. The risk of experiencing bacteraemia after everyday oral procedures is associated with the severity of periodontal inflammation because the ulcerated pocket epithelium may facilitate bacterial entrance into the circulation and because of the pronounced accumulation of bacteria in the region.[2,3]

Bacteraemia occurs immediately after the treatment but is usually ceased after 30 min. Spread of bacteria to the blood can be prevented by good oral hygiene. A diverse bacterial population, including new species, can be isolated from blood after routine or invasive dental procedures. Pre-procedural mouthrinsing with various antiseptic agents have shown to reduce the risk of bacteraemia.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a newly discovered virus, from the Coronavirus family. Its recent outbreak caused a major pandemic of the Coronavirus disease (COVID-19).[4] The primary entry of this virus is believed to be by projected droplets leading to a first contact and colonization of cells in the oral cavity, nose or eyes.

The transmembrane protein angiotensin-converting enzyme 2 (ACE2) was identified as the main host cell receptor of SARS-CoV-2 and entrance portal of the virus into the cell. There is an abundant expression of ACE2 in different oral cavity mucosae, mainly in epithelial cells of the tongue, T cells, B cells, and fibroblasts of the oral mucosa. There is also a high expression of ACE2 in salivary glands, especially in minor salivary glands. It has been suggested that salivary glands may act as reservoirs for COVID-19 asymptomatic infections and transmission.[4]

There is evidence that the virus accumulates at the oral mucosae in the first 10 days of infection and at a subsequent time it will accumulate in the lungs. Therefore, the oropharynx may be an important reservoir for SARS-CoV-2. The virus is detected in

the saliva of the oral cavity and deep throat in high viral loads. The magnitude of the viral load presented in saliva may be one of the factors which contribute to easy transmission, even when symptoms are mild.[5]

Periodontal pocket could be a niche for SARS-CoV-2 virus infection. The virus could find in

Table 1: Studies evaluating CHX as pre-procedural mouthrinse

Sl. No	Author & Year	Agents used in the study	Result & Conclusion
1	A E Veksler *et al* in 1991[10]	▪ Test: CHX + Scaling and root planning (SRP) ▪ Control: Distilled water + SRP	▪ 0.12% CHX showed 96% decrease in bacterial load at 60 minutes(min). ▪ 0.12% CHX showed 77% decrease in bacterial load at 30 mins.
2	Rubens F de Albuquerque Jr *et al* in 2004[13]	▪ 0.12% CHX (Periogard) (1/80 dilution) for 30 secs ▪ 0.05% CPC (cepacol) (1/20 dilution) for 30 secs	▪ Minimum inhibitory dilution (MID) = 1/80 ▪ CHX effective in reducing microorganisms.
3	Magda Feres *et al* in 2010[14]	▪ 0.05% CPC ▪ 0.12% CHX ▪ Water	▪ Reduction in levels of spatter. ▪ Effectiveness of CPC similar to CHX.
4	Eapen Thomas *et al* 2011[15]	▪ 0.12% CHX (Colgate Periogard) ▪ 0.05% CPC (Johnson & Johnson's Reach)	▪ Periogard (CHX) showed increased % of reduction of aerobic and anaerobic microorganisms.
5	Shantipriya Reddy *et al* 2012[16]	▪ Sterile water ▪ Non tempered CHX 0.2% ▪ Tempered CHX 0.2% (22°C – 60°C)	▪ Tempered CHX showed increased reduction of viable bacteria.
6	Nihal R Devker *et al* 2012[17]	▪ 0.2% CHX ▪ HVE ▪ 0.2% CHX + HVE	▪ 0.2% CHX and HVE showed effectiveness in reducing microbial load. ▪ 0.2% CHX + HVE showed more effectiveness.
7	Gunjan Gupta *et al* 2013[19]	▪ 0.2% CHX ▪ Herbal (Hiora – Himalaya) ▪ Water	▪ 0.2% CHX showed more efficacy than herbal mouth rinse.
8	Shamila K Shetty *et al* 2013[18]	▪ CHX(Rexidine) 0.2% ▪ EO – Tea tree oil (Emoform) ▪ Distilled water	▪ When comparing CHX with distilled water, CHX showed more efficacy. ▪ When comparing tea tree oil with distilled water, tea tree oil is better. ▪ On comparing CHX with tea tree oil, CHX showed more efficacy.
9	Dolanchanpa Dasgupta *et al* 2013[19]	▪ A: Without oral prophylaxis ▪ B: Full mouth oral prophylaxis ▪ C: 10 ml CHX 0.12% for 30 secs ▪ D: 5 ml PVP-I 2% ▪ E: 20 ml EO	▪ CHX showed more efficacy followed by PVP-I and then EO.
10	Nicholas B Duvall *et al* 2013[20]	▪ 0.12% CHX ▪ 2g Amoxicillin ▪ Placebo	▪ CHX showed similar reduction in bacteraemia as that of Amoxicillin. ▪ Bacteraemia was most in PLAC, fewer in CHX and least in Amoxicillin group.

periodontal pocket a favourable environment to replicate and to reach continuously the oral cavity and mix with saliva, or to migrate systemically using the capillary periodontal complex.

Studies suggest that aerosolized SARS-CoV-2 can remain in the air for up to 3 hours.[6] Due to the

11	Ravleen Kaur *et al* in 2014[21]	▪ 0.12% CHX ▪ 1% PVP-I ▪ O3	▪ CHX, PVP-I and ozone showed similar CFU reduction
12	Allison Hunter *et al* 2014[22]	▪ Listerine ▪ Decapinol ▪ CHX 0.12% ▪ No rinse	▪ Bacterial colonies per plate was lowest in CHX group, followed by Decapinol and Listerine. ▪ No rinse group showed highest number of bacterial colonies.
13	T V Narayana *et al* 2016[23]	▪ CHX (0.12%) ▪ HVE	▪ Both CHX and HVE showed high efficacy in reducing aerobic and anaerobic microbial load. ▪ CHX combined with HVE was found to be more efficient.
14	Amruta Arun Joshi *et al* 2017[24]	▪ 0.05% CPC at 18°C and 47°C ▪ 0.2% CHX at 18°C and 47°C	▪ CPC at 47°C showed more effectiveness.
15	Rodrigo Dalla PriaBalejo *et al* 2017[25]	▪ 0.12% CHX (13 Gingivitis, 13 Periodontitis patients)	• 0.12% CHX did not reduce bacteraemia.
16	Belén Retamal-Valdes *et al* in 2017[26]	▪ 0.075% CPC + 0.28% Zinc (Zn) + 0.05% F ▪ 0.12% CHX ▪ Water ▪ No rinsing	▪ 0.075% CPC + 0.28% Zn + 0.05% F showed 70% fewer CFU ▪ 0.12% CHX showed 77% fewer CFU ▪ Conclusion: CHX more effective
17	P H Sette-de-Souza *et al* 2020[27]	▪ CPC ▪ CHX 0.12% ▪ H2O2 1.5% - 3.0% ▪ PVP-I 0.5% - 1.5%	▪ O.12% CHX more effective
18	Paul B *et al* in 2020[29]	▪ 94.5% Aloe vera (AV) extract ▪ 0.2% CHX ▪ 1% PVP-I	▪ 94.5% AV showed effectiveness comparable to 0.2% CHX and better than 1% PVP-I.
19	Swet Nisha *et al* in 2021[30]	▪ A – 0.12% CHX ▪ B – 0.75% Boric acid (BA) ▪ C – Water ▪ For 1 min	▪ 0.12% CHX more effective than 0.75% BA.
20	Rola Elzein *et al* in 2021[31]	▪ CHX 0.2% ▪ PVP-I 1% ▪ Distilled water	▪ CHX & PVP-I showed similar efficacy in reducing bacterial load.
21	Seneviratne CJ *et al* 2021[32]	▪ PVP-I (10 mg with 5 ml water) Betadine mouth wash ▪ CHX (0.2%) ▪ CPC – 0.075%	▪ CPC & PVP-I showed similar efficacy in reducing bacterial load.
22	Ashish Jain *et al* in 2021[35]	▪ CHX 2% ▪ PVP-I 1%	▪ CHX 99.9% resulted in inactivation of SARs COV-2 in 30 secs

increased risk of COVID-19 infection among dental personnel, authors, associations and agencies have been recommending preventive measures to be adopted in the dental office, in order to minimize the risk of bacteraemia and cross-contamination.[7,8,9]

This review provides an evidence-based update on various preprocedural mouthrinse used along with dental procedures in reducing the microbial load in dental aerosols and reducing bacteraemia.

Evidence Based Review of Preprocedural Mouthrinses

The objective of this review was to evaluate the efficacy of preprocedural mouth rinses in reducing bacterial and viral load in saliva, oropharyngeal tissues and dental aerosols. An electronic data search of English language manuscripts using keywords pre-procedural, mouthrinse/mouthwash, antiseptic mouthrinse, herbal mouthrinse, SARs COV-2, in PubMed, Google and Wiley Online Library was

TABLE 2: Studies evaluating PVP-I as pre-procedural mouthrinse

Sl. No	Author & Year	Agents used in the study	Result & Conclusion
1	M A Domingo *et al* 1996[18]	▪ 20 ml of 1% PVP-I for 30 secs	▪ Bactericidal effect from immediately after up to 4 hours.
2	Dolanchanpa Dasgupta *et al* 2013[19]	▪ A: Without oral prophylaxis ▪ B: Full mouth oral prophylaxis ▪ C: 10 ml CHX 0.12% for 30 secs ▪ D: 5 ml PVP-I 2% ▪ E: 20 ml EO	▪ CHX showed more efficacy followed by PVP-I and then EO.
3	Ravleen Kaur *et al* in 2014[21]	▪ 0.12% CHX ▪ 1% PVP-I ▪ O_3	▪ CHX, PVP-I and ozone showed similar CFU reduction
4	P H Sette-de-Souza *et al* 2020[27]	▪ CPC ▪ CHX 0.12% ▪ H_2O_2 1.5% - 3.0% ▪ PVP-I 0.5% - 1.5%	▪ O.12% CHX more effective
5	Paul B *et al* in 2020[29]	▪ 94.5% Aloe vera (AV) extract ▪ 0.2% CHX ▪ 1% PVP-I	▪ 94.5% AV showed effectiveness comparable to 0.2% CHX and better than 1% PVP.
6	Rola Elzein *et al* in 2021[31]	▪ CHX 0.2% ▪ PVP-I 1% ▪ Distilled water	▪ CHX & PVP-I showed similar efficacy in reducing bacterial load.
7	Seneviratne CJ *et al* 2021[32]	▪ PVP-I (10 mg with 5 ml water) Betadine mouth wash ▪ CHX (0.2%) ▪ CPC – 0.075%	▪ CPC & PVP-I showed similar efficacy in reducing bacterial load.
8	Chopra *et al* 2021[33]	▪ PVP-I 0.5%	▪ 0.5% PVP-I effective
9	Volha Teagle *et al* in 2022[34]	▪ 0.01% (100 ppm) ▪ Molecular Iodine (MIOR)[PVP-I]	▪ MIOR showed to be effective in reducing SARs COV2 viral load
10	Ashish Jain *et al* in 2021[35]	▪ CHX 2% ▪ PVP-I 1%	▪ CHX 99.9% resulted in inactivation of SARs COV-2 in 30 secs

conducted. Clinical studies published till 31 May 2022 were included in the review. The pre-procedural agents included in this review are CHX, CPC, EO, H_2O_2, PVP-I and herbal agents. Human clinical studies that used pre procedural mouth rinse as a form of intervention for decreasing bacteraemia and the microbial load in saliva, oropharyngeal tissues and dental aerosols were included. There was no restriction on gender, age, ethnicity of individuals. We excluded comments, conference abstracts, interviews, and studies developed in animal models, expert opinions, and case reports. After removal of duplicates, the "title and abstract" of 807 search results were obtained in primary search. Thirty relevant articles were short listed based on inclusion and exclusion criteria. Seven systematic reviews were also included in the review. The full texts of selected studies were then assessed.

Among the twenty-nine articles selected,[10-35, 36-38] the most commonly evaluated preprocedural rinse was CHX. Twenty-two studies evaluated the effectiveness of CHX compared to various agents like distilled water (n=7), CPC (n=7), PVP-I(n=7), EO (3), H_2O_2 (1) and herbal agents (n=2).[10,13-27,29-32,35,38] Twelve of the twenty-two studies showed CHX superior when compared to other agents [distilled water, CPC, PVP-I, EO, H_2O_2, herbal agents].[10,13,15,16,18,22,26,27,30,35,38] There are contradictory results as well. Four studies demonstrated superior effects of CHX over CPC[13,15,26,27] whereas in two studies CPC was found to be more effective.[24,32] Even though four studies demonstrated beneficial effects of CHX over PVP-I,[19,27,29,35] a single study reported contradictory results.[32] Another study which evaluated efficacy of 0.12 percentage (%) CHX in gingivitis and periodontitis patients could not reduce

TABLE 3: Studies evaluating EO as pre-procedural mouthrinse

Sl. No	Author & Year	Agents used in the study	Result & Conclusion
1	D H Fine *et al* in1992[11]	▪ Test: Listerine preprocedural mouth rinsing for 20 – 30 secs ▪ Control: 5% Hydro alcohol	▪ Test: 94.1 % reduction in CFU ▪ Control: 33.9% reduction
2	D H Fine *et al* 1993[12]	▪ Cool Mint Listerine	▪ 92.1% decrease of bacteria in aerosol immediately after rinsing. ▪ 91.3% decrease at 40 mins after rinsing.
3	L G DePaola *et al* in 1996[37]	▪ Test: Listerine ▪ Control: 5% Hydro alcohol	▪ 60 – 65% reduction of aerobic and an-aerobic bacteria.
4	Shamila K Shetty *et al* 2013[18]	▪ CHX 0.2% ▪ EO – Tea tree oil ▪ Distilled water	▪ When comparing CHX with distilled water, CHX showed more efficacy. ▪ When comparing tea tree oil with distilled water, tea tree oil is better. ▪ On comparing CHX with tea tree oil, CHX showed more efficacy.
5	Dolanchanpa Dasgupta *et al* 2013[19]	▪ A: Without oral prophylaxis ▪ B: Full mouth oral prophylaxis ▪ C: 10 ml CHX 0.12% for 30 secs ▪ D: 5 ml PVP-I 2% ▪ E: 20 ml EO	▪ CHX showed more efficacy followed by PVP-I and then EO.
6	Allison Hunter *et al* 2014[22]	▪ Listerine ▪ Decapinol ▪ CHX 0.12% ▪ No rinse	▪ Bacterial colonies per plate was lowest in CHX group, followed by Decapinol and Listerine. ▪ No rinse group showed highest number of bacterial colonies.

bacteraemia.[25] Some studies multiple comparisons were done using different agents(n=12). CHX was found to be equally effective as CPC, PVP-I, AV and Ozone (O_3) as per five studies.[14,21,29,31] CHX was found to be superior when combined with high volume evacuator (HVE) as per two studies.[17,23] Thus, based on the evidence obtained from the selected articles CHX can be strongly recommended as an effective preprocedural mouthrinse. (Table 1)

Next to CHX, second most common agent used was PVP-I (n=10).[18,19,21,27,29,31-35] Comparisons were made with CHX(n=7), CPC(n=2), EO(n=1,) distilled water (n=1), H_2O_2 (n=1) and herbal agents (n=1). Three of ten studies showed that PVP-I was more effective in reducing the microbial load.[18,32,33,34] PVP-I showed similar effect when compared with CHX(n=2), O3(n=1), CPC(n=1) and distilled water(n=1) as per 3 studies.[21,31,32] In the remaining four studies PVP-I was inferior when compared with CHX(n=4), CPC(n=1), EO(n=1), O3(n=1) and herbal agents(n=1).[19,27,29,35] Based on the evidence obtained PVP-I can also be considered as a pre procedural mouthrinse especially in reducing the viral load. (Table 2)

Six studies evaluated efficacy of EO(n=6) in comparison with 5% hydroalcohol (n=3), PVP-I (n=1), CHX(n=3) and distilled water (n=1). [11,12,18,19,22,37]

TABLE 4: Studies evaluating CPC as pre-procedural mouthrinse

Sl. No	Author & Year	Agents used in the study	Result & Conclusion
1	Rubens F de Albuquerque Jr *et al* in 2004[13]	▪ 0.12% CHX (1/80 dilution) for 30 secs ▪ 0.05% CPC (1/20 dilution) for 30 secs	▪ Minimum inhibitory dilution (MID) = 1/80 ▪ CHX effective in reducing microorganisms.
2	Magda Feres *et al* in 2010[14]	▪ 0.05% CPC ▪ 0.12% CHX ▪ Water	▪ Reduction in levels of spatter. ▪ Effectiveness of CPC similar to CHX.
3	Eapen Thomas *et al* 2011[15]	▪ 0.12% CHX ▪ 0.05% CPC	▪ Periogard (CHX) ▪ Showed increased % of reduction of aerobic and anaerobic microorganisms.
4	Amruta Arun Joshi *et al* 2017[24]	▪ 0.05% CPC at 18°C and 47°C ▪ 0.2% CHX at 18°C and 47°C	▪ CPC at 47°C showed more effectiveness.
5	Belén Retamal-Valdes *et al* in 2017[26]	▪ 0.075% CPC + 0.28% Zn + 0.05% F ▪ 0.12% CHX ▪ Water ▪ No rinsing	▪ 0.075% CPC + 0.28% Zn + 0.05% F showed 70% fewer CFU ▪ 0.12% CHX showed 77% fewer CFU ▪ CHX more effective
6	P H Sette-de-Souza *et al* 2020[27]	▪ CPC ▪ CHX 0.12% ▪ H2O2 1.5% - 3.0% ▪ PVP-I 0.5% - 1.5%	▪ O.12% CHX more effective
7	Seneviratne CJ *et al* 2021[32]	▪ PVP-I (10 mg with 5 ml water) ▪ CHX (0.2%) ▪ CPC – 0.075%	▪ CPC & PVP-I showed similar efficacy in reducing bacterial load.

Three of the six studies showed that EO was superior compared to 5% hydroalcohol (n=3).[11,12,18] The remaining three studies provided inferior results for EO in comparison to CHX(n=3), distilled water (n=1) and PVP-I (n=1).[19,22,37] EO demonstrates low evidence to be used as pre procedural mouthrinse in comparison to CHX or PVP-I. (Table 3)

Another commonly used mouthrinse is CPC which showed similar effectiveness as compared to PVP-I in one study[32] and another study reported contradictory results. So, there is no evidence to recommend CPC as a pre procedural mouthrinse.[27] (Table 4)

Herbal agents are emerging as mouthrinses in the recent years due to its anti-inflammatory, antimicrobial properties and less side effects. We could find only two studies using herbal agents as preprocedural mouthrinse.[19,29] Herbal extracts were compared with CHX in one study and Aloe Vera extract was compared to CHX and PVP-I in another study. Even though Aloe

TABLE 5: Systematic reviews evaluating efficacy of various pre-procedural agents

Sl. No	Author & Year	Agents used in the study	Result & Conclusion
1	Marui *et al* 2019[39]	▪ CHX ▪ EO ▪ CPC ▪ Herbal	▪ Pre procedural mouth rinses reduced CFU by 64.8%. ▪ Moderate evidence
2	Lakshman Perre-raSamaaranayake *et al* 2021[40]	▪ CPC/CHX/EO ▪ HVE ▪ Rubber dam application	▪ CPC/CHX/EO were found to be effective. ▪ CPC/CHX/EO + HVE showed more effectiveness.
3	Verma *et al* 2021[41]	▪ PVP-I ▪ Listerine ▪ EO ▪ CHX	▪ All agents showed decrease in viral load. ▪ PVP-I most effective. ▪ Insufficient evidence.
4	Silva *et al* 2021[5]	▪ PVP-I ▪ CPC ▪ CHX ▪ H_2O_2	▪ PVP-I effective in reducing viral load in SARs COV2.
5	Alvaro Garcia Sanchez *et al* 2022[43]	▪ PVP-I ▪ CHX ▪ CPC	▪ PVP-I, CHX, CPC demonstrated virucidal activity against SARs COV2 and can be used as pre-rinse.
6	Hernandez *et al* 2022[44]	▪ 1% H_2O_2 ▪ 0.5% or 1% PVP-I ▪ 0.075% CPC ▪ 0.2% or 0.12% CHX ▪ Linolasept	▪ All pre procedural agents reduced viral load of SARs COV2. ▪ Evidence insufficient.
7	Fernandez *et al* 2022[45]	▪ PVP-I ▪ Listerine ▪ EO ▪ CHX ▪ H_2O_2 ▪ Sterile phosphate buffered saline ▪ EDTA ▪ Quaternary ammonium compounds	▪ CHX effectively reduced viral load of HSV-1, Influenza A and SARS COV2.

Vera showed comparable effectiveness to CHX, the evidence for herbal agents to be used as pre procedural mouthrinse is still insufficient.[29] (Table 1)

Seven systematic reviews were included in the review.[5,39,40,41,42,43] (Table 5) Two of the systematic reviews by Verma et al[41] and Silva et al in 2021[5] showed that PVP-I significantly reduced viral load in SARS-CoV-2. But the evidence was still insufficient. Further randomised clinical trials are needed, with larger sample size. Four systematic reviews by Marui et al 2019[39], Lakshaman Perrera et al 2021[40], Alvaro Garcia et al 2022[42] and Hernandez et al 2022[43] emphasized on the need for pre procedural mouth rinsing and also highlighted the efficacy of various pre procedural agents (CHX, EO, CPC, PVP-I, H_2O_2) in reducing bacteraemia and viral load in saliva, oropharyngeal tissues and dental aerosols. One systematic review by Fernandez et al 2022[44] comparing CHX, Listerine, EO, Sterile phosphate buffered saline, PVP-I, H_2O_2, Quaternary ammonium compounds and Ethylenediaminetetraacetic acid (EDTA). The findings of the study suggested that CHX is highly efficient in reducing viral load of herpes simplex virus-1(HSV-1), Influenza A and SARS-CoV-2. Evidence from the systematic reviews recommends the use of pre procedural mouthrinse due to its various beneficial effects. (Table 5)

Conclusion

The oral cavity is a unique environment which provides an ideal medium for bacterial growth. Past studies have demonstrated that dental procedures generate maximum amount of dental aerosols and bacteraemia. Periodontitis and gingivitis patients as compared with healthy individuals are at increased risk of experiencing bacteraemia in association with dental procedures. The present review highlights the importance of pre procedural mouth rinsing in reducing bacteraemia and dental aerosols especially during the current pandemic era. According to the present review pre-procedural rinsing for 30 seconds to 60 seconds with antimicrobial agents have shown to significantly reduce bacteraemia and aerosol contamination. Chlorhexidine (either 0.12 or 0.2%) and Povidone Iodine (PVP-I) are effective pre procedural agents which reduces the risk of bacteraemia and aerosol contamination.

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Timing of Post Extraction Implant Placement - A Review

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ABSTRACT

The demand for dental implant has grown over the past years. Clinical decisions regarding timing, method, materials, cost, assessment of potential risks has to be taken into consideration before the replacement of a teeth that is indicated for extraction. Determining the best timing of implant placement is critical for its long-term function and aesthetics while reducing the complications. Thorough understanding of the changes taking place in the alveolar process, post extraction is essential for the decision making regarding the timing of implant placement. This article intends to review the biological events post extraction and the different timing protocols of implant placement.

Keywords : dental implant, post extraction, placement timing, healing implant

Introduction

For more than half a century, dental implants have been used to restore lost teeth. They are regarded as a significant contribution to dentistry since they have changed the process of replacing lost teeth with a high success rate[1,2,3]. The capacity of the implant material to integrate with the surrounding tissue is critical to its success. Several factors, including implant material, bone quality and quantity, and implant loading situation, all influence this integration. When single or many teeth are extracted, the edentulous section of the alveolar ridge undergoes a sequence of changes. Following the extraction of a tooth, there is no perfect moment when the extraction site displays maximum bone fill in the socket and voluminous mature covering mucosa[4].

The conventional clinical protocol proposed by Branemark for placement of dental implants involves two phases. The two-stage surgical approach significantly reduces the risk of transfer of unwanted forces to the implant/bone interface during healing, however, a second surgical intervention is required to connect the implant's healing caps. In addition, this second surgical intervention hinders the continuation of rehabilitation for several weeks required for complete healing of the soft tissue around the healing cap[5]. Simultaneously, Straumann AG (Basel, Switzerland) developed an implant system using a single surgical stage[6]. In this one-stage method, the surgical flap was sutured around the implant neck, thus avoiding the need for a second surgical intervention[6].

Rationale for Dental Implant Treatment

Chewing capacity, speech, facial appearance, and self-confidence are all harmed when teeth are lost for any reason. As a result of tooth loss, the surrounding bone begins to deteriorate due to lack of function. By

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exerting direct stresses on the bone, dental implants help to maintain bone levels[7]. Removable partial and complete dentures, on the other hand, have the opposite effect on bone levels.

Sunken face as a result of tooth loss is another key aspect. Because of the absence of use, the muscles of mastication atrophy as a result of tooth loss, giving the patient a sunken aspect[8]. Dental implants let the patient to correctly employ his or her masticatory muscles, preventing atrophy[8]. Dental implants are the closest replacement of natural teeth which drastically improves the patient's self-confidence[8].

Timing of Implant Placement

Determining the best timing to place the implant is critical for achieving the goals set out in all implant-prosthodontic rehabilitation treatments, which include guaranteeing the restoration's long-term function and aesthetics while minimising morbidity. Extraction may be required for a variety of reasons, ranging from significant caries that prevent rehabilitation to acute or chronic endodontic, periodontal, or traumatic infections. Implant placement in a good alveolar process is critical for both functional and cosmetic rehabilitation[9]. The alveolar bone is a tissue that grows during tooth eruption and is modified after tooth loss and is dependent on the tooth.

Dimensional alterations after extraction will have a direct impact on the clinical process that follows. The literature shows a reduction in height and width in the first six months as a result of alveolar modelling and remodelling; these vertical alterations are shown to be roughly 11% to 22 % six months after extraction, and 32 % horizontally after three months, reaching 63 % at six months[10]. According to studies, the vestibular cortical bone suffers the most damage[11]. If there have been multiple extractions, there are no adjacent teeth, the bone quality is poor, and there is infection, the effect of bone loss is larger and varies[11,12].

The first month has the highest percentage of dimensional changes, followed by a lesser percentage in subsequent months, culminating in the loss of contour in soft and hard tissues[10]. Interindividual variation exists in the spectrum of these dimensional changes: the thin periodontal biotype is more prone to resorption and recession than the thick biotype with low scalloping.

Classification of Timing of Implant

Hammerle and colleagues devised a new categorization that took into account data describing structural changes that occur after tooth extraction, as well as knowledge gained from clinical observations[13]. There are four alternative time frames for implant implantation according to the classification of timing after tooth extraction created by the third ITI Consensus Conference in 2003. The term post extraction sites were used to describe collectively fresh and healing extraction sites that permit implants to be placed immediately (type 1), early after soft tissue healing (type 2), and early after partial bone healing (type 3)[14]. After that, Chen and Buser revised it in 2008 and published it in 2009 to create a temporal categorization based on wound-healing[15].

Table: 1 Classification and descriptive terms for timing of implant placement after tooth extraction (Chen and Buser[15])

Classification	Descriptive terminology	Desired clinical outcome
Type 1	Immediate placement	An extraction socket with no healing of bone or soft tissues
Type 2	Early placement- with soft tissue healing (4-8 weeks post tooth extraction)	A post extraction site with healed soft tissues but without significant bone healing
Type 3	Early placement- with partial bone healing (12-16 weeks post tooth extraction)	A post extraction site with healed soft tissues and with significant bone healing
Type 4	Late placement (more than 6 months of healing post tooth extraction)	A fully healed socket

Biological Events

The events that take place in a healed extraction socket have been found in both animal and human biopsies. The first stage reveals a coagulum of white and red blood cells forming an early clot. At four to five days, the clot is replaced by granulation tissue in the second stage. Endothelial cells are also involved in the formation of budding capillaries at this stage. Between days 14 and 16, connective tissue composed of fibroblasts and collagen fibres replaces the granulation tissue, completing stage three. Calcification of the osteoid begins at the base and spreads outward during the fourth stage. Trabeculae bone fill occurs by 6 weeks. After days twenty-four to thirty-five, the epithelium has completely closed, and significant bone filling has taken place. By week sixteen, bone fill is complete[14,16,17,18,19].

Table 2: Advantages and disadvantages of different timing protocols[29]

Classification	Advantage	Disadvantage
Type 1- (Immediate)	• Reduced number of surgical procedures • Reduced post operative pain at times • Reduced overall treatment time • Optimal availability of existing bone • Ability to immediately temporise	• Site morphology may alter implant placement, anchorage and angulation • Thin tissue biotype may compromise optimal outcome • Potential lack of keratinised mucosa for flap adaptation (this can be overcome with simple release type incisions and/or tissue grafting) • Adjunctive surgical procedures may, therefore, be required • Procedure is technique sensitive
Type 2 (4-8 weeks)	• Increase soft tissue area and volume facilitates soft tissue flap management • Resolution of any inflammatory local pathology	• Site morphology continues to be an issue in the early stages of healing. Although the osteoid formation has begun trabeculae bone fill does not occur 6 weeks. Further dimensional changes have already begun. • Treatment time is increased • Socket walls will vary in the amounts of resorption • Adjunctive surgical procedures may be required • Procedure continues to be technique sensitive
Type 3 (12-16 weeks)	•At this stage substantial bone fill has occurred facilitating implant placement • Flap management is simplified by soft tissue maturation • Significant amount of dimensional changes have already occurred • Potentially increased predictability	• Treatment time is increased for both healing of the socket and wait for osseointegration of implant • Adjunctive grafting surgical procedures may be still required • Socket walls exhibit varying amounts of resorption
Type 4 (More than 6 months)	• Clinically dimensional changes post 6 months are minimal • Soft tissue changes post 6 months are usually purely maturational • Sufficient keratinised tissue	• Treatment time is increased • May still require adjunctive procedures • Remaining bone may vary significantly

External Dimensional Changes at Extraction Sockets

It is impossible to ignore the immediate post-extraction dimensional changes to the combined soft tissue and osseous structure. The horizontal ridge width is lowered by five to seven millimetres during the first six months, which represents a 50% reduction from the initial ridge width[14,20,21]. There have also been reports of vertical reductions of two to four and a half millimetres[20,21]. When multiple nearby extraction sites are compared to single tooth extraction sites, greater vertical alterations occur[19,22]. Bone alterations in the buccolingual direction can range from three to six mm[19,23,24]. As a result, early intervention implant placement strategies evolved in attempt to reduce surgical operations, improve patient satisfaction, and reduce the amount of bone loss that happens after extraction.

Integration of Implant

The tissue-implant interface is where most of the events that lead to an implant's integration into bone, and hence determine the device's performance. This interface's creation is complicated and incorporates a number of aspects. Not only do these comprise implant-related aspects like material, form, topography, and surface chemistry, but also mechanical stress, surgical technique, and patient variables including bone amount and quality[25]. Titanium implants interact with biological fluids and tissues after insertion. For the quick loading of dental implants, direct bone apposition onto the titanium surface is essential. Both prosthetic biomechanical characteristics and patient hygiene are critical for the long-term success of the implants after the initial stages of osseointegration.

Following implantation, there are two types of responses. A fibrous soft tissue capsule is formed around the implant in the first kind. This fibrous tissue capsule prevents adequate biomechanical attachment of the dental implant, resulting in clinical failure. Direct bone–implant contact without an intermediate connective tissue layer is the second form of bone response[26]. Numerous studies have shown that the surface roughness of titanium implants influences osseointegration and biomechanical fixation rates[27]. Because of their resemblance to bone tissue, the chemical makeup of the implant surface can be further changed by coating it with hydroxyapatite and titanium oxide layers. The production of implants entails machining, assembly, and acid etching and blasting or combination of all [28].

In conclusion, the rates of healing and success for immediate (Type 1), early (Types 2 and 3), and delayed placement (Type 4) are all comparable. Additionally, a randomized control trial (RCT) comparing early and immediate insertion in the aesthetic zone came to the conclusion that "immediate implant placement is a feasible alternative to early implant placement if accomplished by a competent surgeon"[13,14]. Every clinical case needs to be judged on its own merits. The schedule of implant placement should be determined by a thorough assessment that starts with a patient's medical history and ends with radiographic analysis and consideration of the clinician's experience.

TYPE 1: Placement of an implant as part of the same surgical procedure and immediately following tooth extraction[4]

Implant placement has become popular following the extraction of teeth that were recommended for extraction for a variety of reasons. It was suggested that placing an implant in a fresh extraction socket would accelerate bone tissue growth and osseointegration, so counteracting the condition. Botticelli et al investigated hard tissue modifications in the alveolar ridge during a 4-month period of healing following implant implantation in new extraction sockets and found that virtually all marginal gaps had disappeared after 4 months of healing following extraction and implant placement. This suggests that placing an implant in a fresh extraction socket may not prevent physiologic modelling in the ridge after tooth removal[4].

TYPE 2: Completed soft tissue coverage of the tooth socket

The soft tissue is comparably developed at this point, has adequate volume, and may be handled easily throughout flap elevation and replacement procedures. The presence of a large volume of soft tissue at the implant placement site and type 2 will allow for accurate flap management and good healing[4].

TYPE 3: Substantial bone fill has occurred in the extraction socket[4]

The socket walls are frequently fully resorbed and replaced with woven bone during this time. The socket's entrance is sealed with a woven bone cover that is in the process of being remodelled. The mucosa that covers the extraction site is mature and easier to treat since it is located on a mineralized ridge[4].

TYPE 4: The alveolar ridge is healed following tooth loss[4]

The ridge is lined with a mature, well-keratinized mucosa that lies on dense cortical bone at this time. A portion of alveolar bone is occupied by cancellous bone beneath the cortical bone plate. This stage requires more treatment duration and more loss of ridge volume[4].

Esthetics and Biotype Considerations

When used in the aesthetic zone, Type 2 installation is frequently favoured. The larger amount of soft tissue that has grown during the first weeks of healing after tooth extraction is a benefit. It aids in the prevention of bone atrophy. The soft and hard tissue biotypes may have an impact on the cosmetic outcome of implant therapy. Buccal tissue recession at single-tooth implants was shown to be more apparent in thin biotype individuals compared to thick biotype patients[4].

Success of Treatment

Type 1 implant placement is a successful and predictable clinical procedure, according to various clinical investigations. When titanium implants were unloaded from the extraction socket, success and survival were observed to be similar to implants placed in the healed ridge, with a better degree of osseointegration. According to a few studies, type 2 and 3 placements have similar survival rates to type 1 and 4 placements[4].

Conclusion

A dental implant is a surgical component that is used to restore the lost teeth. Success and failure of implant depends on many factors like health of patient, medications taken by patient and the condition of periodontium. The stress on the implant during regular function should also be evaluated. A detailed understanding of the structural alterations that take place in the alveolar process after tooth extraction should serve as the foundation for any decision about the time of post extraction implant implantation.

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Platelet Rich Fibrin with alloplast as a novel treatment for hopeless tooth: A Case Report

Anoop S[1], Suchitra A[2], Santhosh Kumar S[3], Roshni Ramesh[4], Ajith Kumar K C[5]

ABSTRACT

Background: Periodontal regeneration of hopeless teeth represents a major concern for clinicians. Osteoinductive materials available in market are relatively expensive which most patients cannot afford. This case report demonstrates radiographic bone fill in an isolated complex intrabony defect with non-containing topography around lower right premolar which had been treated by a novel approach using Platelet rich fibrin (PRF) and alloplastic bone graft.

Case presentation: A 35-year-old female patient presented a lower right premolar with >10 millimetre(mm) clinical attachment loss (CAL) and >10 mm probing pocket depth (PPD) on the buccal, mesial, distal and lingual aspects with no recession and intact papilla, 2mm keratinized tissue, grade III mobility and vital. After regenerative treatment using PRF and alloplast there were significant clinical and radiographic improvements with minimal morbidity for the patient.

Conclusion: This case report demonstrates that PRF in combination with an alloplast is an optimal therapeutic approach for periodontal regeneration in an intrabony defect around a tooth with a hopeless prognosis. Before referring such teeth for extraction, clinicians should consider that it is possible to regenerate such defects.

Key Words: Periodontitis, bone grafts, platelet rich fibrin, osseous defects, periodontal regeneration, periodontal surgery

Introduction

True regeneration of periodontal tissues which have been lost as a consequence of periodontal disease progression has been almost an unrealistic goal in Periodontics. Although histologic documentations have shown that true periodontal regeneration is possible with therapeutic modalities such as osseous grafting, enamel matrix derivative and guided tissue regeneration (GTR), outcomes of such modalities are not always predictable.[1,2] Platelet Rich Fibrin (PRF) is an autologous, second generation platelet concentrate which is activated by a natural mechanism; thus releasing growth factors and cytokines in a slow rate during a period of seven days or more.[3] Because of its inherent osteoconductive and osteoinductive properties PRF application was shown to create a well vascularized space, facilitating cellular events that are favourable for periodontal regeneration including bone formation.

This case report demonstrates radiographic bone fill in an isolated complex intrabony defect with non-containing topography around lower right premolar which had been treated by a novel approach using PRF and alloplastic bone graft. The basic principle of this technique is combining the space maintaining

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and scaffolding property of alloplastic materials and growth factor induced osteoinductive property of PRF.

Clinical Presentation

A 35-year-old female patient reported to our department complaining of loose lower right back tooth. She noticed loosening of tooth two years back and the mobility gradually increased thereafter. Her medical history was non-contributory, and she denied a history of smoking or alcohol consumption. Extra oral examination revealed no significant findings. On oral examination, 45 had >10 mm clinical attachment loss (CAL) and >10 mm probing pocket depth (PPD) on the buccal, mesial, distal and lingual aspects with no recession and intact papilla (figure. 1), 2mm keratinized tissue and grade III mobility. The tooth retained its vitality in spite of bone loss extending beyond the apex radiographically. Periodontal examination revealed fair oral hygiene status with simplified oral hygiene index (OHI-S) of 2.7 at baseline. The gingiva around 45 had moderate inflammation with bleeding on probing. Her overall gingival index (GI) was 2.6 at baseline. Pre-operative intraoral periapical radiograph (IOPAR) showed severe bone loss around 45 extending beyond apex (fig. 9). Patient was diagnosed as Generalised stage III periodontitis and was informed about the questionable prognosis of the tooth and very high failure chance. Written informed consent was obtained.

Case Management

A pre-surgical full mouth scaling was completed using ultrasonics. Two weeks after scaling, root planing was done using extended shank mini curettes; instrumented as far apically as possible. After that the tooth was provisionally stabilized with wire and composite splint using a 22-gauge orthodontic wire (fig.1). Cusps of the teeth were selectively reduced to make out of occlusion.

Open flap debridement and regenerative surgery was performed with firm marginal tissues for manipulation, depicting low inflammation one month after root planing. After giving adequate anesthesia using lignocaine-adrenaline (1:100000) a modified internal bevel incision was given using a no.15 Bard-Parker blade. The flap was raised (figure 2 and 3) and final scaling and root planing done with a combination of

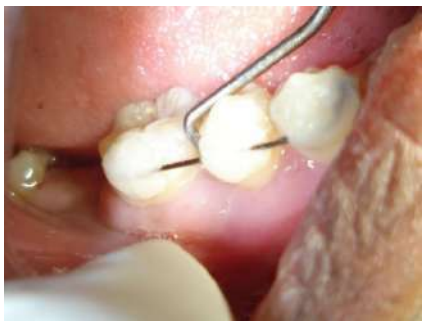

Figure 1 Pre-operative photograph showing deep pocket around 45

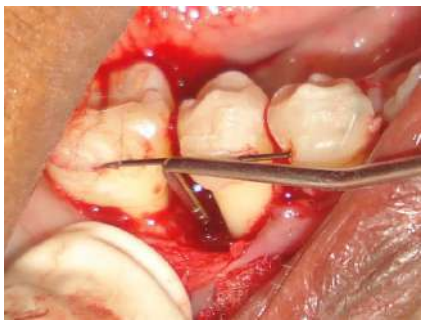

Figure 2 Defect exposed after giving incisions- facial view

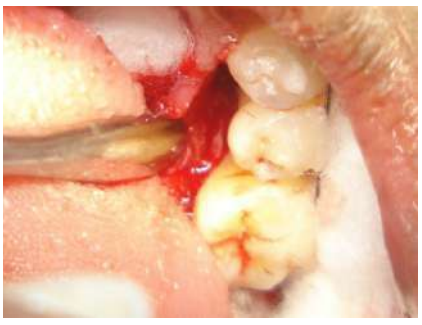

Figure 3 Defect exposed after giving incisions- lingual view

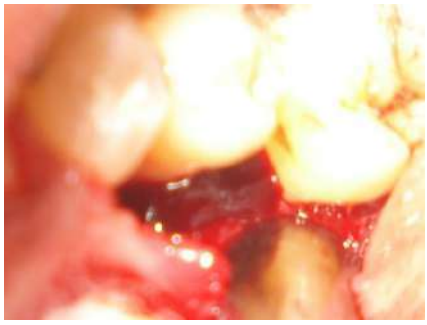

Figure 4 PRF placed at the bottom of the defect

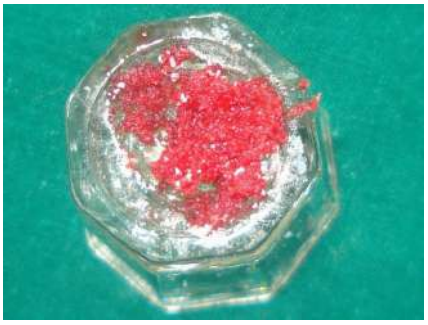

Figure 5 Alloplast mixed with patient's blood

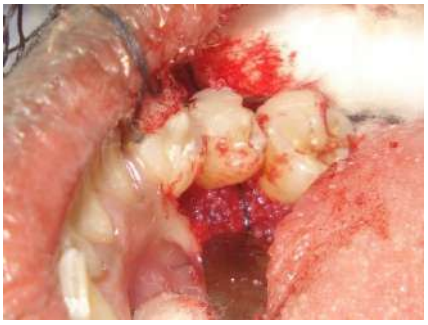

Figure 6 Alloplastic material placed over PRF

ultrasonics and mini curettes without disturbing the apical part of teeth to prevent severing of nerves and vessels entering apical foramen to maintain vitality. The bottom part of the defect was filled with PRF figure 4) prepared from patient's own blood using a protocol proposed by Choukroun et al.[4] The rest of the defect was filled with an alloplastic bone graft† (figure 6) mixed with patient's own blood (figure 5). The flap was repositioned and sutured (figure 7 and 8). Post-operative pain and inflammation were controlled with Aceclofenac 100mg and patient was under antibiotic therapy (Amoxicillin 500mg thrice daily for three days) to prevent infection. Chlorhexidine rinse 0.2% bid was prescribed for two weeks, and the patient was given appropriate postoperative instructions. Sutures were removed after one week. The patient continued to be reviewed at regular intervals of one month, three months, six months and one year. Patient's clinical parameters were assessed at each recall visits (table. 1) and supportive periodontal therapy was given. IOPAR taken at six months (figure 10) and one year (figure 11) follow up visits. Mobility was assessed after removing splint at six months and one year follow up visits.

Clinical Outcomes

Primary wound healing of the incision area was observed one week after surgery. The patient reported little pain or discomfort. There was marked reduction in pocket depth with gain in clinical attachment level and reduction in mobility after one year with insignificant recession, (Table 1). Splint was removed after one year since mobility was reduced dramatically. Radiographically there was significant fill of bone defect.

Discussion

Recent evidence from a literature suggests that regenerative therapy can be applied at hopeless teeth and has the potential to change their prognosis; it is a

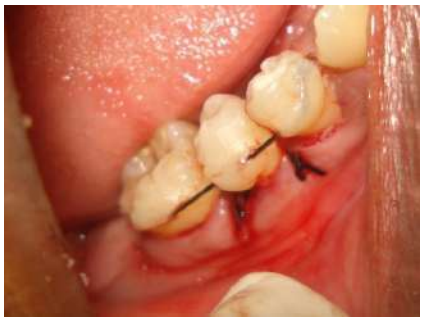

Figure 7 After sutures - facial view

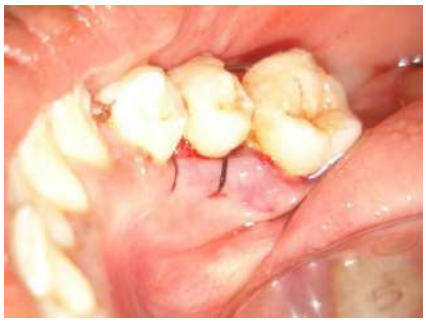

Figure 8 After sutures - lingual view

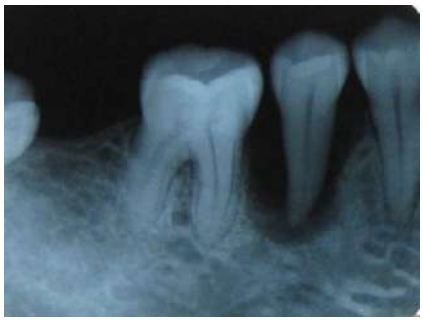

Figure 9 Pre-operative radiograph showing 45 with deep intrabony defect extending beyond apex

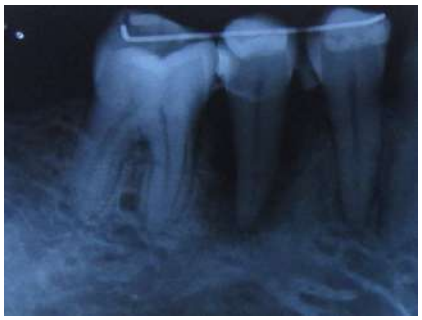

Figure 10 Post-operative radiograph taken after 6 months showing considerable filling of defect around 45

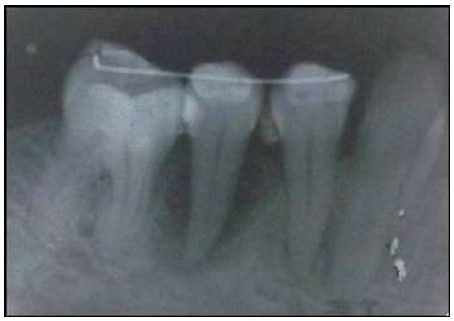

Figure 11 Post-operative radiograph taken after 1 year showing significant filling of defect around 45

† Sybograft, Eucare Pharmaceuticals (P) Ltd, Chennai, India

suitable alternative to extraction of severely compromised teeth with intra-bony defects to or beyond the root apex.[5] PRF is prepared naturally without adding anticoagulants and it is hypothesized that PRF has a natural fibrin framework and can protect growth factors from proteolysis which results in slower and sustained release of platelet and leukocyte derived growth factors in to the wound area.[6] PRF is simpler and less expensive to prepare, as well as being less risky to the patients.

In this case report, the decision to utilize PRF in the intrabony defect was to deliver the growth factors in the early phase of healing. Despite the fact that PRF is a denser and firmer agent than other biological preparations, such as Platelet Rich Plasma (PRP) and enamel matrix derivative (EMD), it is still nonrigid to a degree that its space maintaining ability in periodontal defects is non-ideal, so it was decided to place alloplast over PRF for space maintenance. Literature depicts that PRF in combination in with bone mineral had the ability in increasing the regenerative effects in intrabony defects.[7] Amorphous PRF when used along with xenograft for augmentation in maxillary atrophic cases showed reduced healing time and favourable bone regeneration.[8]

There was significant reduction in pocket depth and gain in clinical attachment at six months followup. Radiographs revealed significant bone fill in the intrabony defect compared to baseline. PRF could improve the periodontal osseous defect healing, as PRF can up regulate phosphorylated extracellular signal regulated protein kinase expression and suppress the osteoclastogenesis by promoting secretion of osteoprotegerin (OPG) in osteoblasts cultures.[9] Moreover, PRF increases cell attachment, proliferation and collagen related protein expression of human osteoblasts.[10] PRF also enhances phosphorylated – extracellular signal regulated kinases, OPG and Alkaline phosphatase expression which benefits periodontal regeneration by influencing human periodontal ligament fibroblasts.[11]

From this case report, it can be concluded that PRF combined with an alloplast is an optimal therapeutic approach for periodontal regeneration in an intrabony defect around tooth with hopeless prognosis in terms of reduction in probing pocket depth, gain in clinical attachment level, significant radiographic

Table 1- Comparison of clinical parameters at various time intervals

	baseline	1 month	3 month	6month	1 year
OHIS‡	2.7	0.3	1.5	1.5	2
GI§	2.6	0.7	1.2	1	1.4
Probing Pocket Depth in millimetre(mm) around 45					
Mesial	>10	-	6	6	6
Buccal	>10	-	4	4	4
Distal	>10	-	5	5	5
Lingual	>10	-	4	4	4
Clinical attachment loss in mm around 45					
Mesial	>10	-	6	6	6
Buccal	>10	-	4	4	4
Distal	>10	-	5	5	5
Lingual	>10	-	4	4	4
Mobility	Grade III	-	-	Grade II	Grade I
Vitality	positive	positive	positive	positive	Positive

‡ Simplified oral hygiene index (Greene and Vermillion,1964)
§ Gingival index (Loe and Silness,1963)

defect bone fill, improved patient comfort and early wound healing process. However, longterm, multicentre randomized, controlled clinical trial will be required to know its clinical, radiographic and histologic effect on bone regeneration.

Conclusion

This case report presents a new approach for periodontal regeneration around hopeless tooth with optimal results. Tooth with hopeless prognosis has been retained and maintained with sufficient bone fill radiographically. The procedure is less technique sensitive and materials are cheaper than other modalities of treatment for periodontal regeneration. The keys to successful management of this case include skill level of the therapist, thoroughness of instrumentation, oral hygiene maintenance of patient, adequate soft tissue to contain graft and PRF, regular supportive therapy and adequate.

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Gingival Pigmentation – A Review

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ABSTRACT

Of all the colours in the animal kingdom, the wide spread and most important to man is melanin. Besides providing pigmentation, it also plays an essential role in defending the body against harmful Ultraviolet (UV) rays and other environmental challenges. Other than physiological pigmentation, various disorders can also cause hyperpigmentation. Gingival pigmentation plays a key role in facial esthetics and before undergoing any depigmentation procedure it is absolutely necessary to exclude any other pathological conditions affecting gingival pigmentation. In this review, we discuss the physiology and biochemistry of pigmentation, racial and intra oral variations in gingival pigmentation, disorders of pigmentation and various methods for depigmentation.

Keywords: Gingiva, melanin pigmentation, melanocytes, gingival depigmentation techniques

Introduction

Colours abound throughout the animal kingdom. The wide spread and most important to man is melanin, which also gives colour to the feathers of the birds, beetles and slugs, and fills the ink sacs of the octopus and the squids. Melanin pigmentation is highly heritable, being regulated by genetic, environmental, and endocrine factors that modulate the amount, type, and distribution of melanin in the skin, hair, and iris of eyes.[1] Melanin also plays an essential role in defending the body against harmful UV rays and other environmental challenges. It has been traditionally believed that skin pigmentation is the most important photo protective factor, as melanin, besides functioning as a broadband UV absorbent, has antioxidant and radical scavenging properties.[2] In this review we discuss the physiology and biochemistry of pigmentation, various indices used for gingival pigmentation, disorders of pigmentation and various depigmentation procedures.

Physiology of Gingival Pigmentation

Melanin is a non–hemoglobin-derived pigment formed by the melanocytes, which are dendritic cells of neuroectodermal origin located in the basal and spinous layers of the gingival epithelium.[3] Melanin pigmentation appears as early as three hours after birth in the oral tissues and in some cases is the only sign of pigmentation on the body.[4] The number of melanocytes in the mucosa corresponds numerically to that of skin; however, in the mucosa their activity is reduced. Melanin can be of three types. Eumelanin which imparts black or brown colour, Phaeomelanin which imparts red colour and Neuromelanin which

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is present in nervous system. Melanin from natural sources has reported to possess protection against UV radiation, enzymatic lysis and damage by oxidants.[5]

Biochemistry of Pigmentation

The process of pigmentation consists of three phases[6]:

I) Activation of melanocytes: The activation phase occurs when the melanocytes are stimulated by factors like stress hormones, sunlight etc. leading to production of chemical messengers like melanocyte stimulating hormone.

II) Synthesis of melanin: In synthesis phase, melanocytes make granules called melanosomes. Both eumelanins and phaeomelanins are derived from amino acid tyrosine. Tyrosine isoxidized to 3,4-dihydroxyphenylalanine (DOPA) by the copper containing enzyme tyrosinase, which also catalyses the future oxidation of dopaquinone. Tyrosinase catalyses the first two steps of melanin production. (Figure 1)

III) Expression of melanin: In expression phase, melanosomes are transferred from the melanocytes to the keratinocytes which are the skin cells located above melanocytes in the epidermis. After this, melanin colour eventually becomes visible on the surface of skin.

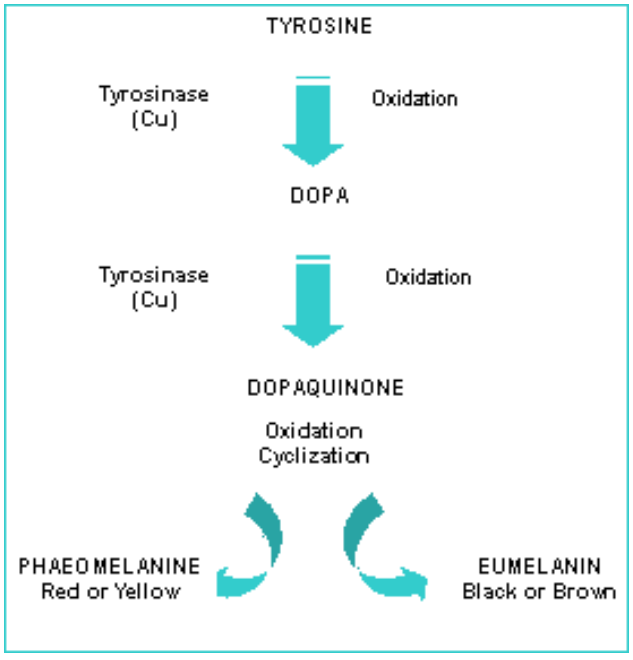

Figure 1. Melanin Synthesis

It is generally agreed that pigmented areas are present only when melanin granules synthesized by melanocytes are transferred to the keratinocytes. Dendritic melanocytes account for only 1% of epidermal cells. Each basal layer melanocyte is associated with about thirty six keratinocytes and one Langerhans cell (epidermal melanin unit).[7]

Racial Differences in Melanosomes

Although the number of melanocytes is essentially constant, the number, size, and the manner in which the melanosomes are distributed within the keratinocytes vary. In general, more deeply pigmented skin contains numerous single large melanosomal particles that are ellipsoidal and intensely melanotic. Lighter pigmentation is associated with smaller and less dense melanosomes that are clustered in membrane bound groups.[8] (Figure 2)

Intra Oral Variations in Pigmentation

There are two basic colour zones in the oral cavities of most people which comprise the attached and marginal gingiva on one hand and the adjacent alveolar mucosa on the other hand.[9] Studying gingival colour using the Munsell colour system in dentistry, Ibusuki (1975) reported that gingival colour varied with the position of the papillary, marginal

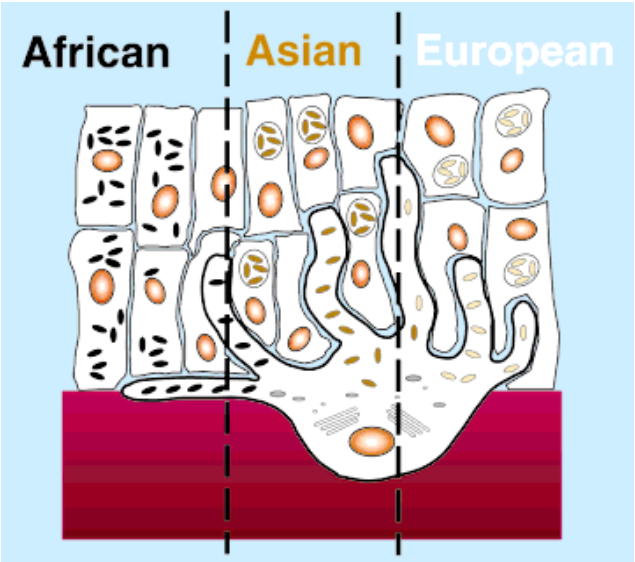

Figure 2. Schematic representation of a single melanocyte in different races

and attached gingiva.[10] A study to correlate skin colour and gender with intensity and distribution of gingival melanin pigmentation in a group of South Indians by Ponnaiyan et al found that South Indians predominantly have pigmentation in attached gingiva and interdental papilla. It appeared that the degree of gingival pigmentation of the gingiva and skin was reciprocally related. The highest rate of gingival pigmentation was observed in the area of the incisors. Incidence of pigmentation did not differ between the sexes.[11]

Disorders of Pigmentation

Apart from physiologic pigmentation, pigmentation can occur due to systemic or local causes.

Systemic and local causes of pigmentation[16]

Localized Pigmentations
Amalgam tattoo, graphite or other tattoos, nevus, melanotic macules, melanoacanthoma, malignant melanoma, Kaposi's sarcoma, verruciform xanthoma
Multiple or Generalized Pigmentations
Genetics: Idiopathic melanin pigmentation (racial or physiologic pigmentation), Peutz-Jegher's syndrome, Laugier-Hunziker syndrome, spotty pigmentation, endocrine overactivity, Carney syndrome, Leopard syndrome, and lentiginosisprofusa
Drugs: Smoking, betel, anti-malarials, antimicrobials, minocycline, amiodarone, clorpromazine, ACTH, zidovudine, ketoconazole, methyldopa, busulphan, menthol, contraceptive pills, and heavy metals exposure (gold, bismuth, mercury, silver, lead, copper)
Endocrine: Addison's disease, Albright's syndrome, Acanthosis nigricans, pregnancy, hyperthyroidism
Post inflammatory: Periodontal disease, postsurgical gingival repigmentation
Others: Haemochromatosis, generalized neurofibromatosis, incontinentiapigmenti, Whipple's disease, Wilson's disease, Gaucher's disease, HIV disease, thalassemia, pigmented gingival cyst, and nutritional deficiencies

INDICES USED FOR GINGIVAL PIGMENTATION

Various indices used are:

ORAL PIGMENTATION INDEX (DOPI)[12]

(Dummett 1964)

This index of oral pigmentation is the commonly used index due to its simplicity and ease of use. The scores are as follows:

0	No clinical pigmentation (pink-colored gingiva)
1	Mild clinical pigmentation (mild light brown color)
2	Moderate clinical pigmentation (medium brown or mixed pink and brown color)
3	Heavy clinical pigmentation (deep brown or bluish black color)

DOPI Assessment - Sum of assigned estimates of components ÷ 32 unit spaces

The DOPI Assessment is scaled according to the following designations:

0	No clinical pigmentation of the gingiva
0.031 - 0.97	Mild gingival pigmentation
1.0 - 1.9	Medium gingival pigmentation
2.0 - 3.0	Heavy gingival pigmentation

MELANIN INDEX [13] (Hedin 1977)

This index has classified pigmentation as follows:

Degree I	No pigmentation
Degree II	One or two solitary unit(s) of pigmentation in papillary gingiva without the formation of a continuous ribbon between solitary units
Degree III	More than three units of pigmentation in papillary gingiva without the formation of a continuous ribbon
Degree IV	One or more short continuous ribbons of pigmentation
Degree V	One continuous ribbon including the entire area between canines

MELANIN PIGMENTATION INDEX[14] (Takashi *et al* 2005)

The index is as follows:

Score 0	No pigmentation
Score 1	Solitary unit(s) of pigmentation in papillary gingiva without extension between neighbouring solitary units
Score 2	Formation of continuous ribbon extending from neighbouring solitary units

According to Peeran et al, in 2014[15] the above indices seemed to lack the capacity to relate various aspects of gingival pigmentation. They are also not determining the patient's treatment need. Moreover, other gingival-pigmented lesions are beyond their scope, as they were intended only for racial pigmentation.

Proposed gingival melanin pigmentation and pigmented lesions index by Peeran et al

Score 0	Coral pink-colored gingiva, no gingival pigmentation, and/or pigmented lesions
Score 1	Mild, solitary/diffuse, gingival melanin pigmentation involving anterior gingiva, with or without the involvement of posterior gingiva
Score 2	Moderate to severe, solitary or diffuse, gingival melanin pigmentation involving anterior gingiva with or without the involvement of posterior gingiva
Score 3	Gingival melanin pigmentation only in posterior gingiva
Score 4	Tobacco-associated pigmentation: Smoker's melanosis, chewing tobacco
Score 5	Gingival pigmentation due to exogenous pigments-Amalgam tattoos, arsenic, bismuth, chewing betel nut, cultural gingival tattooing, drinks, food colors, lead-burtonian line, mercury, silver, topical medications and idiopathic.
Score 6	Gingival pigmentation due to other endogenous pigments: Bilirubin, blood breakdown products, ecchymosis, hemochromatosis, hemosiderin, petechiae.
Score 7	Drug-associated gingival pigmentation: Antimalarial drugs, minocycline, oral contraceptives
Score 8	Gingival pigmentation associated with other causes: Addison's disease, Albright's syndrome, basilar melanosis with incontinence, hereditary hemorrhagic telangiectasia, HIV patients, lichen planus, neurofibromatosis, Peutz-Jeghers syndrome, pyogenic granuloma/ granulomatous epulis
Score 9	Pigmented benign lesions: hemangioma, melanocytic nevus, pigmented macule
Score 10	Pigmented malignant lesions: Angiosarcoma, Kaposi's sarcoma, malignant melanoma

A clinician may recommend a depigmentation procedure when the patient scores 1-2 score in the index and has up to class 2 of **Liebart and Deruelle**[15] Smile line classification, which is as follows:

Class 1	Very high smile line - more than 2 mm of the marginal gingiva visible
Class 2	High smile line - between 0 and 2 mm of the marginal gingiva visible
Class 3	Average smile line - only gingival embrasures visible
Class 4	Low smile line - gingival embrasures and cemento-enamel junction not visible.

Depigmentation Methods

Though not a medical problem, cosmetic demands by patients warrant depigmentation procedures. Before depigmentation procedures, it is important to exclude any pathologic reasons for pigmentation. **Roshna & Nandakumar** in 2005[17] classified different gingival depigmentation methods as:

I. Methods used to remove the gingival pigmentation:

A. Surgical methods:

a. Scalpel surgical technique

b. Bur abrasion method

c. Electro-surgery

d. Cryosurgery,

e. Lasers,

f. Radiosurgery.

B. Chemical methods.

II. Methods used to mask the gingival pigmentation:

a. Free gingival graft.

b. Acellular dermal matrix allograft

Conclusion

Facial aesthetics involves the interaction of many elements of the periodontium, of which gingival pigmentation is one. Patient awareness and expectations have increased to a point where less than optimal esthetics is no longer acceptable. Before undergoing any depigmentation procedure, it is absolutely necessary to exclude any other pathological conditions affecting the gingival pigmentation. Success of the depigmentation procedure may be weighed only by the extent of depigmentation achieved and by the time taken for reappearance of pigments.

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A Clinico-Radiographic Study to Gauge the Correlation between the Remaining Interdental Bone Height and Early Site of Furcation Involvement

Swetha V R[1], Angel Fenol[2], Biju Balakrishnan[3], Lakshmi Puzhankara[4]

ABSTRACT

Background: Periodontal disease is an inflammatory disease affecting the supporting tissues of teeth; triggered by host response to periodontal pathogens. There occurs connective tissue attachment loss first slowly progressing to alveolar bone loss later on. Early bone loss occurring at the furcal area of multi-rooted teeth are difficult to diagnose clinically alone. Combination of clinical probing and a diagnostic investigation helps in identifying the early bone loss in such areas much easier.

Objective: This study aims to investigate the remaining interdental bone height on mesial and distal sides of maxillary and mandibular permanent first molars and to correlate it with early site of furcation involvement.

Materials and methods: Fifty Intraoral Periapical Radiographs (IOPARs) of both maxillary and mandibular permanent first molars of subjects with moderate to severe periodontitis (3-4 millimeters (mm) and >5 mm of clinical attachment loss respectively) were evaluated for remaining interdental bone height on mesial and distal aspects. Clinically, the grade of furcation involvement (grade 1 and early grade 2) was assessed using the Naber's Probe and radiographically interdental bone loss was assessed.

Results: The results show that there is statistically significant involvement of the mesial furcation first when there is distal root displaying bone loss. Also, there is statistically significant involvement of the lingual furcation first when there is mesial root showing more bone loss.

Conclusion: Assessment of interdental bone levels using radiographic aids can provide a reliable investigatory method to identify early furcation involvement. A thorough clinical and radiographic examination is essential for a successful treatment outcome.

Keywords: Clinico-radiographic study, alveolar bone loss, early diagnosis, furcation defects

Introduction

Periodontitis is a common inflammatory disease affecting the supporting tissues of the teeth. It is triggered by host immune response to periodontal pathogens. Initially connective tissue attachment loss occurs progressing to loss of alveolar bone, which is a characteristic of periodontitis. Early bone loss presents as crestal bone loss leading to interdental osseous defects as the disease progresses [1]. Furcation areas of multirooted teeth are of great importance as they are the areas which challenge the success of periodontal therapy [2]. Furcation is said to be involved when periodontal disease affects bifurcation or trifurcation of a multirooted tooth [3]. Reduced efficacy of periodontal treatment has been observed frequently in multirooted teeth. The morphology and limited access for mechanical control to the furcal area helps periodontitis to affect this region much early [2].

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Furcation involvement may be due to many factors like morphological factors which include root trunk length, furcation entrance width, enamel projections into the furcation, bifurcation ridges, closeness of the furcation to cemento-enamel junction (CEJ), and other modifying factors like trauma from occlusion[4]. Also, improper control measures in removing the dental plaque in the furcation area can lead to their early involvement. Thus, furcation defects pose a formidable problem necessitating early diagnosis and treatment for long term success. The furcation involvement diagnosis has always been an issue. Depending on the conventional diagnostic procedures like radiographs, they have only limited susceptibility and dependability for early diagnosis of furcation involvement. Also, probing clinically alone depends on various factors like probing force, angulation etc. Study by Ross and Thompson[8] reported that only 3% and 9% of maxillary and mandibular molar furcation involvement respectively, can be detected by clinical examination alone. But when combined with radiographs, it improved from 3% to 65% in maxillary molars and from 9% to 25 % in mandibular molars.[5] Trans gingival probing under anaesthesia validate the depth and configuration of the furcation defects, but the information is still blind.[6]

Hence, we need to bring a combined diagnostic method which is simple and cost effective and at the same time helps in early diagnosis of site of furcation involvement for a proper treatment plan and long-term treatment success.

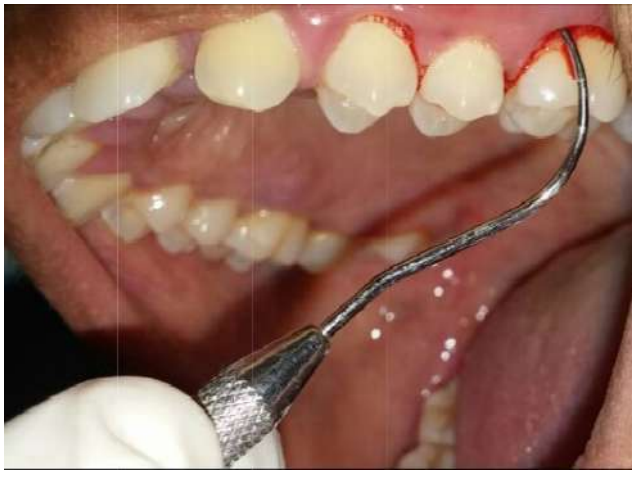


Figure 1: Clinical assessment of furcation involvement using Naber's probe

This study was undertaken to examine the remaining bone height interdentally on mesial & distal sides of maxillary and mandibular permanent first molars and to correlate it with early furcation involvement.

Materials and Methods

This cross-sectional study was conducted in the Department of Periodontology in Amrita School of Dentistry, Kochi. Ethical approval for the study was obtained from the Amrita Vishwa Vidhyapeetam University, Kochi, Kerala, India (dated 10/1/2015). Fifty Intraoral Periapical Radiographs of both maxillary and mandibular permanent first molars of subjects with moderate to severe periodontitis (as defined by American Academy of Periodontology 1999) visiting the outpatient wing of Department of Periodontics of our institution were evaluated. International workshop for Classification of periodontal diseases by American Academy of Periodontology,1999, diagnosed periodontitis as moderate and severe based on the clinical attachment loss of 3 - 4 mm and >5 mm respectively [7] . There are several classification systems of furcation involvement. The present study uses the system proposed by Glickman [9] which is grade I: Soft–tissue lesion extending to fluting but no furcal bone loss; Grade II: Loss of furcal bone to varying degrees, but not through and through; Grade III: Through and through but not clinically visible; Grade IV: Through and through visible clinically.

Clinically, furcation involvement was assessed using Naber's Probe (PQ2N, Hu Friedy, Chicago) on the buccal, mesial and distal furcations of maxillary first molars and buccal and lingual furcations of mandibular first molars (Figure I). Grade 1 and early grade 2 furcation involvement were included for the study as grade 1 furcation involvement is the incipient lesion and in early grade 2 furcation involvement the lesion can affect one or more furcations of the same tooth [8] .

Inclusion criteria included patients of age group 30 - 75 years diagnosed with moderate to severe periodontitis of clinical attachment level (CAL) 3-4mm and >5 mm respectively[7], patients with well aligned

maxillary & mandibular first molars with identifiable CEJ and those who were willing to participate in the study.

Exclusion criteria were patients with teeth having extensive restorations, trauma from occlusion, fused roots; subjects with systemic disease/ condition/ medication that causing gingival enlargement, patients with history of periodontal treatment in the last six months, patients having oral conditions which interfere with clinical/radiographic evaluation of furcation involvement and pregnant and lactating women.

The complete history and a detailed clinical examination were procured. Patients were informed about the purpose and procedure of the study and an informed consent for voluntary participation was obtained.

Radiographic Assessment

The patients were subjected to radiographic assessment, maintaining all radiation safety standards and was done with the help of IOPARs of the maxillary and mandibular first molars with Rinn XCP holder using paralleling (or long cone) technique. Into the holder, IOPA radiographic film was placed along with the radiographic grid which consists of grid lines of 1 mm. The study participants were instructed to bite on to the holder. Using the ring holder, the cone was placed in the direction of the sensor. Radiographs were exposed using ENDOS ACP (VILLA SISTEMI) machine operating at 70 kilovoltage peak (kVp) & 8 milliampere (mA). The images were captured with No: 2 size E Speed film, exposed for 0.32 seconds.

From the total fifty IOPARs taken, the interdental bone loss was calculated as measurement from CEJ to the point where the bony defect was identified or where the lamina dura was intact. The most coronal point where the periodontal ligament space showed continuous width was taken as the depth of the bony defect[10]. In case of inability to recognise the periodontal ligament space, the point where the alveolar crest projection crossed the root surface was taken as the reference point. If both structures are identifiable, the periodontal ligament point reference was used as bony defect. When more bony contours could be identified, the most apical point present in relation to the tooth was taken as the bony defect [9]. The root trunk length was calculated from CEJ to the roof of the furcation. All the distances were measured in millimetres (by counting the number of squares (1mm)) present between these anatomical points. Remaining bone support percentage on mesial and distal sides was determined by the percentage of the difference between these two distances. (Figures 2 ,3)

Statistical Analysis

The mesial and distal interdental bone loss values were calculated from the radiographs. From this, the percentage of mesial root length and distal root length which showed bone loss was derived. The furcation site corresponding to the interdental bone loss was also calculated (measured clinically using Naber's probe). The correlations of the percentage of remaining interdental bone height on mesial and distal sides to the early site of furcation involvement were analysed using Spearman's Rho test, which was considered significant at 0.05 level.

Results

The maxillary and mandibular first molars

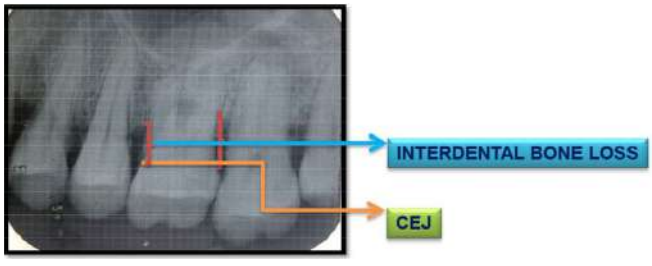


Figure 2 : Maxillary IOPAR – Anatomical Points For Measurements

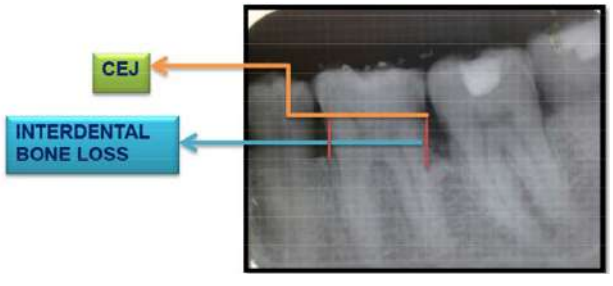


Figure 3: Mandibular IOPAR – Anatomical Points For Measurements

wherein which furcation involvement was observed is represented in Tables 1 and 2 respectively.

Table 1 – Grade and site of furcation involvement in maxillary first molars.

	GRADE 1	GRADE 2	NO INVOLVE-MENT
Buccal Furcation	9	4	14
Mesial Furcation	16	9	2
Distal Furcation	7	4	16

Total number of teeth examined – 27

Table 2 –Grade and site of furcation involvement in mandibular first molars.

	GRADE 1	GRADE 2	NO INVOLVE-MENT
Buccal Furcation	**9**	**5**	**9**
Lingual Furcation	**14**	**5**	**4**

Total number of teeth examined – 23

The mean percentage interdental bone loss values on mesial and distal sides in both maxillary and mandibular first molars are represented in Figure 4 and Figure 5 respectively

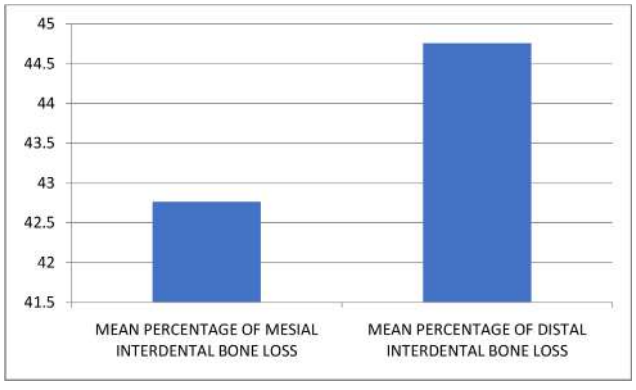
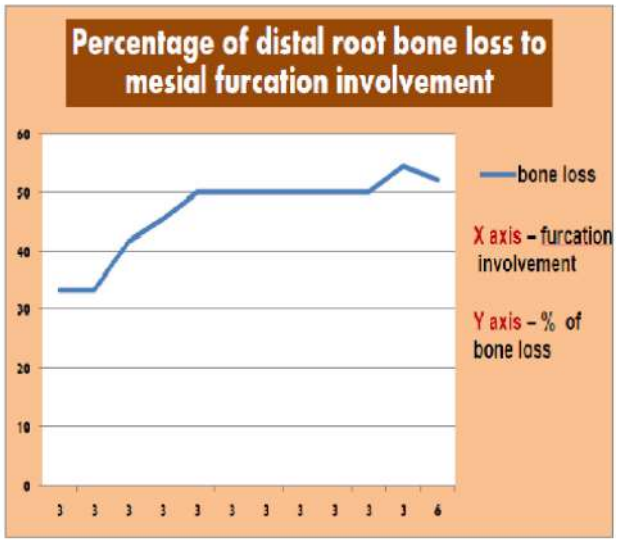


Figure 4 – Mean percentage of mesial and distal interdental bone loss in maxillary first molars

Figure 4 shows the mean percentage interdental bone loss on mesial and distal sides of maxillary 1st molars and from the figure, it is seen that interdental bone loss is more on distal side than on the mesial. Figure 5 shows the mean percentage interdental bone loss on mesial and distal sides in mandibular 1st molars and it shows that mesial side has more interdental bone loss than the distal side.

Figure 4 a –Percentage of distal root bone loss to mesial furcation involvement in maxillary first molars



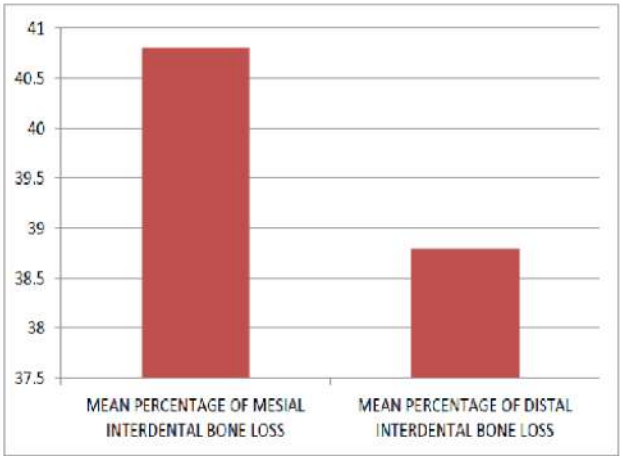


Figure 5 – Mean percentage of mesial and distal interdental bone loss in mandibular first molars

Figure 4 b - Correlation of the buccal, distobuccal and mesiobuccal furcations of maxillary first molars with that of the percentage of root length showing bone loss.

	Buccal	Mesiobuccal	Distobuccal
PMBL	0.60	0.35	0.66
PDBL	0.85	**0.05***	0.71

***-statistically significant p<0.05**

PMBL – Percentage of mesial root length showing bone loss

PDBL – percentage of distal root length showing bone loss

Figure 4 a and 4 b shows the correlation of early furcation involvement with that of the root length showing bone loss in maxillary 1st molars. From these figures, it is clearly seen that there is higher chances of early involvement of mesial furcation when there is distal root displaying bone loss in maxillary first molars.

Figure 5 a – Percentage of mesial root bone loss to lingual furcation involvement mandibular first molars

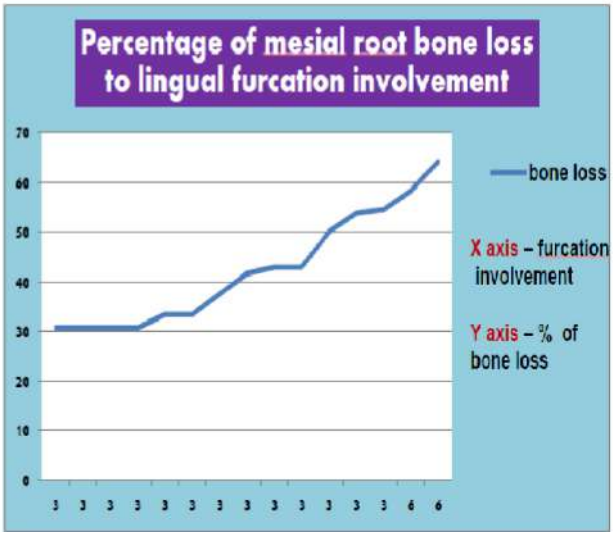


Figure 5 b - Correlation of the buccal and lingual furcations of mandibular first molars with that of the percentage of root length showing bone loss.

	Buccal	LINGUAL
PMBL	0.48	**0.05***
PDBL	0.10	0.70

***- statistically significant p<0.05**

PMBL – Percentage of mesial root length showing bone loss

PDBL – percentage of distal root length showing bone loss

Figure 5 a and 5 b shows the correlation of the early furcation involvement with that of the root length showing bone loss in mandibular 1st molars. From both these figures, it is clear that the chances of lingual furcation getting involved early is high when there is mesial root displaying bone loss in mandibular first molars.

Discussion

Early detection of furcation involvement helps in charting out a proper treatment plan. For diagnosing this, we should have a thorough knowledge about the furcal anatomy of multirooted teeth, which is crucial for treatment success. Furcation involved teeth has loss of attachment 2.5 times more when compared to the teeth without furcation involvement [11]. Study by Mlachkova et al in 2008 reported that loss of bone in furcation area of 1mm and more correlated with the loss of interdental bone of above 4mm^2.

There are various clinical and radiographic methods by which we can assess furcation involvement and interdental bone loss. They mostly applied to assess the outcomes of treatment. Zybutz et al in 2000 concluded that assessment of loss of bone in furcation area both clinically and radiographically are reliable in evaluating the outcome of treatment.[12]

Radiographic measurements reflect the consequences of the periodontal disease on dentoalveolar

structures. IOPA radiographs are obtained easily and give us an idea about the disease state in one particular area. Instead of measuring from the enlarged IOPA radiographs or using the computer software program, in this study we have taken IOPARs along with a radiographic grid, as any magnification of the radiograph would result in the corresponding magnification of the grid image and the measurement obtained will not have variation from the actual value.

In this study, we have correlated the remaining interdental bone height on mesial and distal sides with that of incipient or early involvement of furcation. This study perhaps is a first study evaluating the site of incipient and early furcation involvement in first molars with that of interdental bone loss. In this study, maxillary & mandibular permanent first molars were assessed for early furcation involvement clinically with Naber's probe. Radiographically, interdental bone loss was measured using x-ray grid.

In our study, it was seen that there is an early involvement of mesial furcation of maxillary permanent first molars with distal interdental bone loss. This may be related to the separation of the opposite roots from the bifurcation and trifurcation center as calculated in the study by Romito and Pustiglioni in 2004[13]. They calculated the mean distance of palatal root to buccal furcation, distal root to mesial furcation and mesial rot to distal furcation. According to their study, with the mean value of 4mm for the trifurcation center, mean distance from the mesial furcation to the distal root was 5.42 ± 0.83 mm (range 3.78-7.07 mm),which was the shortest when compared to the distances between the other furcation and roots. Hence, even when the probing depth is not larger than 4 mm, there may be a grade I lesion and when the probing depth shows a value larger than 4 mm (i.e., the bifurcation lesion has already passed the centre of the trifurcation), the furcation involvement will be grade II[13].

In this study, it was also seen that for mandibular molars there is early lingual furcation involvement with mesial interdental bone loss. Study by Reem et al in 2011 attributed this to the minimum root trunk length on the buccal and lingual aspects of mandibular first molars, which are 2mm. So even at 2 mm probing attachment level, furcation could be approached[14]. This leads to horizontal attachment loss and more progressive furcation involvement. Also, in the study by Gher and Dunlap in 1985, the authors concluded that the at 0.7 mm and 0.3 mm apical to the CEJ, buccal and lingual concavities were first noted respectively and this gradually approached the furcation[15]. Since the lingual concavity is located at a distance closer to CEJ, plaque accumulation and subgingival plaque deposition is easier since it's a difficult area for plaque control and thus predispose to early involvement of furcation.

The limitations of this study include small sample size. A study on a larger sample size would give stronger evidence to support the correlation between interdental bone loss and early furcation involvement. This study emphasizes the role of IOPARs in routine clinical examination for assessing the interdental bone loss in relation to early furcation involvement so that we can initiate a treatment plan to disrupt the progress of periodontal disease.

Conclusion

From the present study we can conclude that a majority of both maxillary and mandibular permanent first molars show early furcation involvement which may be missed out by the clinician during a routine examination. Also, from this study we can conclude that even when there is 4mm of interdental bone, the clinician should evaluate all the furcations of the molar tooth in both maxillary and mandibular arches. Hence radiographic assessment should be included along with routine clinical examination for furcation involvement assessment.

Clinical Significance

Awareness of site of early furcation involvement helps the clinician in proper diagnosis, which will help to frame a proper treatment plan and improve the prognosis.

Conflict of Interest

No conflict of interest.

Funding

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Intraoral Scanners in Periodontal and Implant Dentistry- An Overview

Nishana[1], Arunima PR[2], Ambili R[3], Reejamol MK[4], Neethu Suresh[5]

ABSTRACT

Intraoral scanners (IOS) are devices that digitally reproduce the 3-dimensional (3D) geometry of the intraoral soft and hard tissues. The intraoral scanner hardware is designed using non-contact optical technologies based on the principle of confocal laser scanner microscopy that results in high-speed scanning. IOS project a light source, such as a laser or structured light, onto the surfaces being scanned and imaging sensors capture video or discrete images that are processed by the device's software to produce a 3D surface model. The light intensity is detected by a photo-detection device, transforming the light signal into an electrical one which is recorded by a computer and can be reconstructed. Multiple generations of IOS technologies and systems are available, making choosing a system based on clinical applications, scanning accuracy, and ability of the scanner to capture tooth surface details.

Keywords: Intraoral scanners, scanning technology, digital impression

Introduction

Digital dentistry has evolved rapidly since the introduction of Computer Aided Design–Computer Aided Manufacture (CAD-CAM) technology in the early 1980s.[1] With the advent of CAD-CAM technology in dentistry, a shift has occurred from conventional to digitization where software technology is utilized to diagnose, categorize the dental treatment procedures. There are two types of initial steps of CAD/CAM technology: direct and indirect imaging method. During indirect approach the workflow starts with a traditional impression taking, then the stone cast is scanned by a laboratory scanner.[2,3] Where as in direct CAD/CAM workflow is to take an optical impression with intraoral scanner (IOS) devices. Intraoral scanner is a medical device used for capturing direct optical impressions composed of a handheld camera (hardware), a computer and a software.[4]

The goal of an intraoral scanners is to record with precision the three-dimensional (3D) geometry of an object by projecting a light source onto the object to be scanned.[5,6] The images captured by imaging sensors are processed by the scanning software, which generates point clouds which are triangulated by the same software, creating a three-dimensional surface virtual model.[7] In the field of Periodontics, the acquisition of digital data with intraoral scanner represents a novel methodology to unequivocally capture and store source data from the gingival tissues more rapidly than standard non-invasive clinical records with enough detail to enable clinicians to also assess a multitude of other oral health parameters used to evaluate oral health. Recently, intraoral scanners are increasingly used in implantology in the place of conventional

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impressions and a 2020 systematic review indicated that scanners utilizing active wave front sampling are more accurate than other techniques employed.[8]

Intraoral scanners provide advantages for data processing while eliminating the need for physical storage space.[9] Among other possibilities, the superimposition of such digital models taken at different time points consists of a valuable tool for three-dimensional quantitative and qualitative assessment of soft and hard tissue changes over time. Thus, the integration of intraoral scanning systems into the digital dental workflow creates a new solution for existing dental treatment modalities. This review sheds light on the applications of intraoral scanners in the field of Periodontology and implant dentistry.

Evolution of Intraoral Scanners

In 1973, the concept of computer-aided design/computer-aided manufacturing (CAD/CAM) was first introduced in dental applications by Dr. Francois Duret in France.[10] A prototype device for digital impression was later presented by Sirona Dental Systems for restorative dentistry in 1987, known as the Chair-side Economical Restoration of Esthetic Ceramics (CEREC®) system. The CEREC system proved to be a pioneering device in the CAD/CAM dental industry.[11] Although the scanning or milling quality may have seemed imperfect, it represented the state-of-the-art at the time, with no competitors arriving until 2008, when the Cadent iTero digital impression system, first launched in 2006, was announced as being capable of full-arch intraoral scanning.[12] Shortly thereafter, Align Technology acquired Cadent in 2011, then integrated iTero into data transmission for Invisalign® therapy.

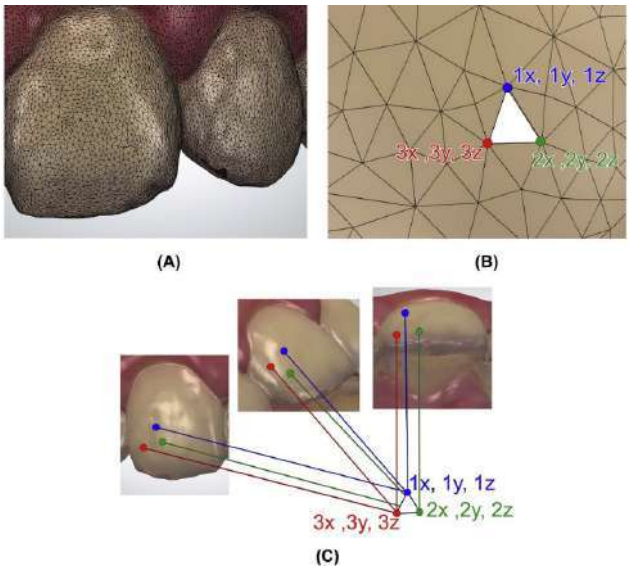

Figure 1: Generation of a STL file by intraoral scanner. (A) An example of a STL file. (B) Each triangle of a STL file is composed by three points with cartesian coordinates (x, y, and z) and a normal surface. (C) Schematic representation of the reconstruction technology: each picture is analysed, and POI are selected by the software. After similarity calculation between different images, a matching of coinciding points of interest is defined and triangles with coordinates are generated by projection matrix.

Scanning Technology

Digital intraoral scanners are considered Class I medical electrical devices, designed and constructed in accordance with the standards of American National Standards Institute/ International Electrotechnical Commission (ANSI/IEC60601-1).

Every scanner has three major components:

i. A wireless mobile workstation to support data entry;

ii. A computer monitors to enter prescriptions, approve scans, and review digital files;

iii. A handheld camera wand to collect the scan data in the patient's mouth.

The most widely used digital format is the open Standard Tessellation Language (STL) or locked STL-like (Figure 1(A)). This format is already used in many industrial fields and describes a succession of triangulated surfaces where each triangle is defined by three points and a normal surface (Figure 1(B)). However, other file formats have been developed to record colour, transparency, or texture of dental tissues (such as Polygon File Format, PLY files). Irrespective of the type of imaging technology employed by IOS, all cameras require the projection of light that is then recorded as individual images or video and compiled by the software after recognition of the points of

interest (POI). The first two coordinates (x and y) of each point are evaluated on the image, and the third coordinate (z) is then calculated depending on the distance to object technologies of each camera, as explained below (Figure 1(C)).

a. Light projection and capture

Within the 3D reconstruction field, there is a clear distinction between passive and active techniques. Passive techniques use only ambient lighting to illuminate intraoral tissues and are reliant on a certain level of texture of an object. Active techniques use white, red, or blue structured lights projected from the camera onto the object that is less reliant on the real texture and colour of tissues for reconstruction. In active techniques, a luminous point is projected onto an object and the distance to the object is calculated by triangulation (process explained later) (Figure 2(a)). An alternative is light pattern projection, such as line or mesh projections (Figures 2(b) and 2(c)). The surface reconstruction can be achieved with a compilation of images, a video that can take several images per second in a continuous data flow, or per wave analysis.[13,14]

b. Distance to Object Technologies

1. Triangulation technique

The triangulation method has long been used in the CEREC system. It is composed of three points: the laser emitter, sensor, and object surface. With known distance and angulation, calculated using the Pythagorean theorem, the object surface information can be acquired. However, to obtain more detail and avoid unpredictable light dispersion, the tooth surface may need to be covered with a thin layer of radiopaque powder, unifying the surface texture (e.g., Optispray® by CEREC, primarily comprising titanium oxide).

2. Confocal laser scanning

Confocal imaging is a technique based on acquisition of focused and defocused images from selected depths (Figure 3(b)). This technology can detect the sharpness area of the image to infer distance to the object that is correlated to the focal length of the lens. A tooth can then be reconstructed by successive images taken at different focuses and aperture values and from different angles around the object. The sharpness area is directly related to the dexterity of the operator who can generate motion blur,[15] and this technique also requires large optics that may lead to difficulties in clinical practice.

3. Active wave-front sampling (3D-in-motion video recording)

This optical sampling method refers to 3D information gathered using a single-lens imaging system for measuring the depth on the basis of the defocus of the primary optics. Lava Chairside Oral Scanner (COS) and

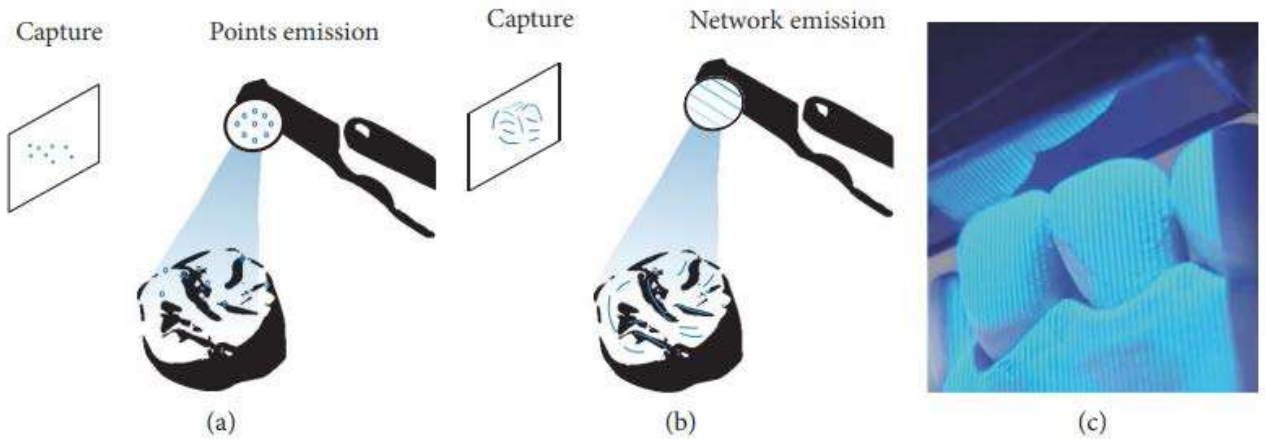

Figure 2: Nature of light. (a) Projection of points. (b) Projection of a mesh. (c) Projection of a mesh by an intraoral scanner.

True Definition both use this technique in their 3D-in-motion video recording technology. Three internal complementary metal–oxide–semiconductor (CMOS) sensors capture 3D information from different perspectives (i.e., image triplets). In addition to the high accuracy it can provide, high data redundancy is one of the unique characteristics. According to 3M ESPE, their active wave-front sampling has evolved into a next generation technique, 3D-in-motion technology, which has three critical features: active wave-front sampling, breakthrough image processing algorithms, and real-time model reconstruction. A thin layer of powder dusting before scanning is recommended to serve as a connector for location reference.

4. Stereophotogrammetry

Stereophotogrammetry estimates all coordinates (x, y, and z) only through an algorithmic analysis of images[16](Figure 3(d)). As this approach relies on passive light projection and software rather than active projection and hardware, the camera is relatively small, its handling is easier, and its production is cheaper.

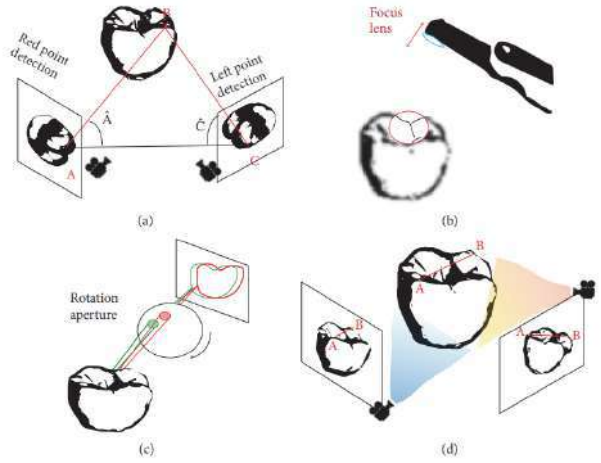

Figure 3: Determining distance to the object. (a) Triangulation: distance BC could be determined according to the formula BC = AC × sin Â /sin A +^Ĉ. (b) Confocal: distance to the object is determined according to the focal distance. (c) Active Wavefront Sampling (AWS) requiring a camera and an off-axis that moves on a circular path around the optical axis and produces a rotation of interest points. (d) Stereophotogrammetry is a technology that generates files by algorithm analysing numerous pictures.

c. Reconstruction Technologies.

- One of the major challenges of generating a 3D numerical model is the matching of point of interest taken under different angles. Distances between different pictures may be calculated using an accelerometer integrated in the camera, but a similarity calculation is more often used to determine the point of view of the image. Using algorithms, similarity calculation defines point of interest coincident on different images. This point of interest can be found by detection of transition areas, such as strong curvatures, physical limits, or differences of grey intensity ("Shape from Silhouette").[17] A transformation matrix is then calculated to evaluate similarity between all images such as rotation or homothety. Extreme points can also be statistically eliminated to reduce noise. Each coordinate (x, y, and z) is extracted from the projection matrix, and a file is then generated.

Advantages of Intraoral Scanners

- Enhanced patient comfort
- Gag reflex management
- Immediate preparation feedback in high magnification (undercut/margin depths)
- Improved patient communication
- No physical study models requiring storage
- Predictable for single teeth/implants/short span bridgework(<5units)
- Streamlined workflow

Disadvantages of Intraoral Scanners

- Initial learning curve
- Unable to displace soft tissue marginal inaccuracies
- Require laboratory familiar with digital technology
- Expensive hardware/annual software agreement
- Unable to register dynamic soft tissue relationships
- Unpredictable for extended edentulous sites

Commercially Available Intraoral Scanners

iTero Element – Align Tech

iTero is a pioneering classic; since Align Technology acquired Cadent, iTero has benefited from its association with Invisalign®. iTero Element enables various forms of communication and offers open-source Standard Tessellation Language (STL) export. The scanner uses parallel confocal technology. The manufacturer claims that a larger wand can obtain a wider view, thus enabling shorter scan times and higher accuracy. They emphasize that their lens has a unique reflective mirror design incorporated into the wand, such that even the most distal tooth would be easy to approach. Another unique feature of the scanner wand is a disposable sleeve covering for easy prevention of infections.

Imaging Principle-3D video, confocal laser scan, red laser, white light-emitting diode (LED).

Figure 4: Intraoral Scanner Model-iTero Element-(Company Name-Align Tech).

TRIOS 3 / TRIOS 3 Wireless – 3Shape

TRIOS 3 uses the Ultrafast Optical Sectioning technique, based on the confocal laser principle. The confocal plane is changed periodically at a certain frequency, such that the operator is not required to move the scanner head position to maintain a relative distance from the object while scanning. Therefore, the scanner has been praised as offering an optimal balance between scan speed and scan accuracy by ***Renne et al.***[18]

Imaging Principle-Ultrafast optical sectioning time-multiplexed (**TM**) confocal laser scan, LED

Lava Chairside Oral Scanner (COS)– 3M

This is a classic intraoral scanner, offering remarkable performance for its time. 3M applied active wavefront sampling technology in it, and consequently it remains comparable to newer scanners, despite being released in 2008.

True Definition – 3M

This scanner has demonstrated high accuracy in several comparative studies. It also possesses the small-

Figure 5: Intraoral Scanner Model-TRIOS 3 Wireless (Company name-3Shape).

est wand with the same size and weight as a conventional dental handpiece. However, spraying a thin layer of powder is suggested to gain superior outcomes. Some clinicians have claimed that a few seconds of dusting is warranted for higher accuracy. Another point differentiating True Definition from other scanners is that it does not offer real-time full-colour scans. 3M focuses primarily on machine development rather than the accompanying software packages, but a variety of applicable choices are available through Trusted Connection and other open-source communications, such as Incognito, Invisalign, Sure Smile, and Clear Correct.

Imaging Principle-3D-in-motion video, active wavefront sampling

Figure 6: Intraoral Scanner Model-Lava C.O.S. (Company Name-3M ESPE)

Figure 7: Intraoral Scanner Model-True Definition (Company name-3M).

CEREC Omnicam – Sirona Dentsply

The CEREC system has the longest history in the CAD/CAM industry. On the basis of the triangulation imaging method, Omnicam differs from the previous Bluecam.[19]Omnicam incorporates video streaming rather than stitching of static images. Powder spraying before scanning is also unnecessary for this generation of Chairside Economical Restoration of Esthetic Ceramics (CEREC).

Imaging Principle-Continuous filming, triangulation, white LED

Accuracy of Intraoral Scanners

The accuracy of the intraoral scanner was evaluated by:

a) Dimensional measurement: Measuring the distance between landmarks on an intraoral scanner generated virtual model and comparing it to the distance between similar landmarks and a physical model. The dimensional measurement evaluated the deviation from the conventional measurement of the physical model.

b) Superimposition accuracy: In this method, two virtual models are superimposed using the principles of best fit alignment. This is followed by quan-

Figure 8: Intraoral Scanner Model-CEREC Omnicam (Company Name-Sirona).

tifying the discrepancy between the models by 3D software. The less the value the greater the accuracy. This method was applied to measure 2 variables:

✓ Trueness: Comparing the intraoral scanner virtual model with the reference virtual model. The trueness measures the deviation from the reference model.

✓ Precision: Comparing the similarity of virtual models generated by the same IOS system. The precision reflects the repeatability of the entire impression procedure.

c) Qualitative evaluation: Following the superimposition process of 2 virtual models, a colour

Evidence-based review on the application of intraoral scanners in the field of Periodontology and implant dentistry

Sl No.	Study	Study Design	Type of Intra-oral scanner	Conclusion
1	**Frank *et al* 2014**[20]	In-vivo and ex-vivo study	iTero intraoral scanner	On comparing the accuracy of the position of intraorally scanned abutments on implants with extraoral scanned analog casts, it was found that a large discrepancy exists between the intraoral scans and the reference scans. The scans of two implants in edentulous mandibles made with scan abutments by using the iTero IOS system lacked sufficient overlapping and stable reference points to make them usable for implant frameworks
2	**Cameron *et al* 2015**[21]	In-vivo study	iTero Intraoral laser scanner	The study evaluated the practical use and accuracy of the intraoral laser scanner with CAD/CAM technology in thirty-six patients restored with a single implant either in posterior aspect mandible or maxilla. The results of digital acquisition through optical scanning have been consistent and accurate. All thirty-six restorations and their corresponding abutments were delivered to the patient in a single office appointment.
3	**Francesco *et al* 2016**[22]	Comparative In-vitro study	• Trios® • CS 3500® • Zfx Intra-scan® • Planscan	On comparison of the trueness and precision of four modern intraoral scanners, in two different situations: in a partially edentulous maxilla with three implants, and in a totally edentulous maxilla with six implants. This study showed no differences in trueness and precision were found between partially and totally edentulous models.
4	**Mario *et al* 2017**[23]	Comparative In-vitro study	• CS3600 • TrioS-3 • Omnicam • True definition	This study compared the trueness and precision of four intraoral scanner in two different situations: a partially edentulous maxilla (PEM) and in a fully edentulous maxilla. The results showed that for CS3600®, Omnicam® and True Definition®, the values obtained in the Partially edentulous model were significantly better than those obtained in the fully edentulous model for implant placement
5	**LiJun *et al* 2018**[24]	In-vivo and ex-vivo study	TRIOS Scanner	The results of the study demonstrated a difference in reproducibility of in-vivo scanning of participants with that of ex-vivo scans of the plaster models of the same participants.

6	**Kim RJ *et al 2019*[25]**	In-vitro study	▪ CEREC Omnicam ▪ CS3600 ▪ i500 ▪ iTero Element ▪ TRIOS 3	This study evaluated the trueness of 5 intraoral scanners (IOSs) for digital impression of simulated implant scan bodies in a partially edentulous model. The overall accuracy was found to be best in the i500 and TRIOS 3 intraoral scanners. The significantly greater range of trueness values were noted particularly in the CEREC Omnicam and CS3600 towards the opposite side of the origin of scanning.
7	**Donghao *et al* 2020**[26]	Comparative In-vivo study	▪ TRIOS color ▪ CEREC Omnicam	On comparison of the accuracy of intraoral digital impressions for gingival contour captured in the esthetic zone in vivo, in dentate situations, the two tested IOS systems achieved a clinically satisfying accuracy for capturing gingival contour in anterior maxilla, with a comparable or superior precision to the conventional impressions.
8	**Sinead *et al* 2020**[27]	In-vivo study	Trios 3 intraoral scanner	This study confirms that IOS images of teeth and soft tissues are sufficiently accurate to allow the clinical evaluation of health or inflammatory gingival status using non-invasive indices. IOS has great potential for efficient and accurate data capture, for general practice and research facilitating remote evaluation and data verification.
9	**Renata *et al* 2021**[28]	In-vivo study	▪ TRIOS® Pod ▪ 3Shape	Intraoral scanning seems to be a sound and reliable tool to evaluate occlusal tooth wear when compared to traditional methods -clinical and photographic examinations.
10	**Hye-Min *et al* 2022**[29]	Comparative In-vivo study	▪ Trios3 ▪ 3Shape	IOS shows superior results than cone-beam computed tomography (CBCT) in assessing supra-alveolar gingival dimension (GD) and the clinical pocket probing depth (PD). IOS has revealed high trueness and precision as compared to CBCT.

map is generated to illustrate the positive and negative differences between the two virtual models. This method indicates the pattern of differences between the models produced from each intraoral scanning system.

Conclusion

After an objective overview of the literature, intraoral scanner seems clinically adapted for common practice, irrespective of the technology used. Each technology has to be considered in the context of individual activity, requirements, and expectations of practitioners. Intraoral scanner has great potential for efficient and accurate data capture, for general practice and research facilitating remote evaluation and data verification. However, there is no scanning technique, scanner, or technology that can currently be unanimously considered more accurate due to the lack of standardized procedures or comparable in vivo studies. Intraoral scanner technology will totally change the 'way of thinking' in the field of dentistry and one can confidently predict that in the coming years we will witness a true digital revolution in the dental office.

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SPIK ANNUAL CONFERENCE

The annual conference of SPIK 2022 was held on 5th June, 2022 at Hotel Aida, Kottayam. The program started with inaugural function at 10 am with collaring of the President by the Secretary followed by invocation. Dr Presanthila Janam, President Elect SPIK welcomed the gathering. Dr Sabu Kurian, President SPIK presided over the function. Past Secretary, Indian Society of Periodontology Dr Balaji Manohar, inaugurated the program by lighting the lamp. Dr Jayan Jacob, Secretary SPIK delivered the vote of thanks.

Registrations were received from the institutions all over Kerala and from Mangalore. A total of 100 delegates participated in the program. Scientific session included presentations from Dr Balaji Manohar, Professor in Periodontics, Kalinga Institute of Dental Sciences, Bhubaneswar on "Ortho-Perio synergy" and Dr Mihir Kulkarni, Associate Professor of Periodontics, SDM College of Dental Sciences on "Successful autogenous soft tissue grafting in Periodontics & Implantology". A session "Perioscope" was presented by Dr Baiju R.M, Dr Majo Ambooken, Dr Arun Sadasivan and Dr Harikumar Menon, where they shared their challenging clinical cases, and was moderated by Dr Jose Paul. Periodontal Awareness videos for both professionals and patients were released and screened during the conference.

Executive committee meeting and Annual General body meeting of SPIK was conducted after the scientific program. New office bearers were installed under the able leadership of Dr Presanthila Janam as the President. The meeting was adjourned at 5pm.

Inaugural function

Awarding of SPIK scholarship
to Mr Ashish Anz by Dr K Nandakumar

Scientific session by Dr Balaji Manohar

Dr Sabu Kurian awarding memento
to Dr Balaji Manohar

Scientific session by Dr Mihir Kulkarni

Dr Sabu Kurian awarding memento
to Dr Mihir Kulkarni

Release of Periodontal awareness video by
Dr Santhosh Sreedhar

Dr Arun Sadasivan

Dr Baiju R.M

Dr Harikumar Menon

Dr Majo Ambooken

Annual general body meeting

Office Bearers 2022-23

WEBINAR

The first webinar of SPIK in 2022 was held on July 15 via Zoom platform, on the topic - Periodontal Plastic Surgery –"From then to now" with Dr Prakash P. S. G as faculty. Scientific Program Convenor Dr Sameera G Nath welcomed the attendees. President SPIK, Dr Presanthila Janam delivered the presidential address. Dr Biju Thomas introduced Dr Prakash P. S. G to the attendees. More than 100 participants attended the webinar. Dr Harikumar K and Dr Baiju Madhavan felicitated the faculty and Secretary Dr Mohammed Feroz T P delivered the vote of thanks.

ORAL HYGIENE DAY

National Oral Hygiene Day was celebrated on August 1, 2022, with a plethora of events. The program began with a Walkathon in association with the Indian Dental Association Thiruvananthapuram Branch,which was flagged of by Dr. Presanthila Janam, President SPIK at 7 am at Kanakakkunnu Palace and ended at the Tennis Club grounds. Periodontal health care convenor of SPIK Dr Manikandan GR, President IDA Thiruvananthapuram Branch Dr Pramod P S and Secretary IDA Thiruvananthapuram Branch Dr Sangeetha G Kurup were also present. The second program was an awareness talk for inmates of Special Prisons Thiruvananthapuram by Dr Manikandan G R. A flash mob was conducted at Lulu mall Thiruvananthapuram in collaboration with PMS College of Dental Sciences Thiruvananthapuram, which had excellent audience participation. Dr Presanthila Janam, Dr Manikandan G R and Dr P S Thaha, Chairman of PMS College of Dental Sciences, addressed the audience. Lulu Mall executives gave away mouthwashes to the audience who correctly answered the simple oral hygiene quiz conducted by Dr Manikandan. SPIK also conducted an e-poster competition for undergraduate and postgraduate students across the state.

Walkathon in association with the Indian Dental Association Thiruvananthapuram Branch

Oral hygiene awareness talk for inmates of Special Prisons Thiruvananthapuram by Dr Manikandan G R

Dr Presanthila Janam, President SPIK addressing the gathering at Lulu mall Thiruvananthapuram

Flash mob conducted at Lulu mall Thiruvananthapuram

Oral hygiene quiz for the public at Lulu mall Thiruvananthapuram

WINNERS OF E -POSTER COMPETITION		
	UNDER GRADUATE	**POST GRADUATE**
1st Prize	Gazali Mohammed & Midhun R (Malabar Dental College & Research Centre) Vishal A M (Sree Anjaneya Institue of Dental Sciences)	Dr Anu John & Dr Keerthana Varma K (Government Dental College Kottayam)
2nd Prize	Shaheema Rahman & Hiba Fathima (Sree Anjaneya Institue of Dental Sciences)	Dr Rehana Bind A (Government Dental College Kottayam)
3rdPrize	Amitha Mathew & Irfana Shajahan (Al Azhar Dental College) Pooja Narayanan (KMCT Dental College)	Dr Praseeda Prasad (Government Dental College Kottayam)