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Indira Gandhi Institute of Dental Sciences  
Nellikuzhy, Kothamangalam 686 691, Kerala, India**







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## REVIEW ARTICLE

# ANTIBIOTIC RESISTANCE AND STEWARDSHIP IN THE CONTEXT OF COVID 19 PANDEMIC: A REVIEW

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### ABSTRACT

The advancements in the field of medicine both in terms of drugs and equipment have played a vital role in improving the quality of life of man. Even when the judicious and wise administration of antimicrobials have reduced mortality and morbidity saving the lives of millions, the introduction and continuous use of antibiotics have put forward a serious concern of emergence of resistant strains. This review gives an insight into the concept of antibiotic resistance and stewardship the context of COVID 19 pandemic.

**Keywords:** Antibiotic resistance, antibiotic stewardship, Covid 19.

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## INTRODUCTION

Antibiotics have drastically altered the healthcare system, bringing even the lethal infections under control. The last few decades have witnessed the advancements in medications and treatment modalities including cancer chemotherapy and organ transplants. Judicious and timely use of antimicrobials have reduced mortality and morbidity saving the lives of millions. The introduction and continuous use of antibiotics have put forward a serious concern of emergence of resistant strains.<sup>1</sup>

The worldwide impact of COVID 19 pandemic cases had an instantaneous and overwhelming impact on the healthcare system and society. The long-term consequences of COVID-19 on antimicrobial resistance have been a grave matter of concern because of elevated administration of antibiotics in patients infected with SARS-CoV-2.<sup>2</sup>

Presently, antibiotic resistance has become a worldwide problem with serious public health, clinical and economic impacts. The common causes of death reported in these cases are due to resistance to antibiotics used in lower respiratory tract infections, such as pneumonia, and blood and intra-abdominal infections.<sup>3</sup>

This review gives an insight into the concept of antibiotic resistance and antibiotic stewardship in the context of COVID 19 pandemic.

## Antibiotic resistance

### Definition

Antimicrobial resistance (AMR) is well defined as the development of resistance of microorganisms to an antimicrobial agent to which they were at first sensitive.<sup>4</sup>

AMR is defined as the resistance of bacterial, viral, parasitic and fungal microorganisms to antimicrobial medicines that were previously effective for treatment of infections.<sup>5</sup>

The substantial upsurge in the population of multi-drug resistant strains which was prevalent globally resulted in its recognition as a major global health threat by World Health Organization (WHO) in 2014.<sup>4</sup>

### Causes

It occurs naturally over time but is accelerated by multiple factors. The main etiological factors associated with antibiotic resistance include inadvertent use of antibiotics by public due to lack of awareness, self-medication, the inappropriate use of antimicrobial medicines in animal, food, agriculture and aquaculture sectors, lack of access to health services, including to diagnostics and laboratory capacity and antimicrobial residues in soil, crops and water.<sup>4,6</sup>

The lack of prevalence data on bacterial co-infection at the initial stages of the pandemic and the latent development of superinfections by the presence of numerous risk factors and long hospital stays, especially in critical ill patients, could significantly lead to higher antibiotic consumption in COVID-19 patients.<sup>6</sup> Antibiotic misuse along with a strained healthcare manpower and work force coupled with compromised immune system lead to antimicrobial resistance as a lasting consequence of the COVID-19 pandemic.<sup>2</sup>

### Mechanisms of resistance

There are many mechanisms of resistance reported in bacteria. Among these, the major mechanisms are enzymatic inhibition, penicillin binding protein (PBP) modifications, porin mutations, efflux pumps, and target changes.<sup>1</sup>

## AR in the context of COVID-19

### Indications of Antibiotic Resistance (AR) in COVID cases

The usage of broad-spectrum antibiotics as a part of COVID-19 treatment was recommended when there exists an overlap of respiratory symptoms of bacterial community-acquired pneumonia with that of COVID-19. According to the latest WHO guidelines in November 2021, it states that antibiotics should not be prescribed for mild and moderate patients without a clinical suspicion of bacterial infection, but for severe patients, they recommend empirical antibiotic therapy to treat all likely pathogens.<sup>7,8</sup>

### Specific causes of AR in COVID patients

It is reported that increased self-antibiotic medica-



tion, inadvertent and empirical antibiotic administration, and antibiotics prescribed by general practitioners were the risk factors of high levels of AR during COVID-19. The extreme apprehension and panic about the situation and the inappropriate use of antibiotics directly had an impact in accessing antibiotics without a prescription, principally low- and middle-income countries where exists a weak system of antibiotic control.<sup>9</sup>

### Prevalence of AR in COVID cases

Few studies indicated that it was due to suspected for-seen bacterial co-infections, antibiotics are widely prescribed for COVID-19 patients in spite of its viral nature.<sup>2</sup> Some studies state that even before the admission to hospitals, approximately 69% of COVID-19 patients used antibiotics (eg: ceftriaxone and azithromycin) with or without a practitioners' consent.<sup>9</sup>

About 64% of cases received antibiotics. Among the 72% of COVID-19 treated with antimicrobials, 8% of these them suffered from bacterial or fungal co-infection. Based on the findings of a meta-analysis, the prevalence of bacterial infection in COVID-19 was estimated to be approximately 8.6%.<sup>2</sup>

#### Trends of AR in COVID-19 cases

The most prevalent gram-negative AR bacteria were *A. baumannii*, *K. pneumonia* whereas the among gram-positive, *S. aureus* and *E. faecium* were the most resistant ones.<sup>2</sup>

Regarding the age of the patient, prescription pattern was found to be least for children and highest for elderly group. In the initial months, an increase in the consumption of amoxicillin-clavulanate, ceftriaxone or azithromycin was reported, while over the months the consumption of broad-spectrum antibiotics.<sup>6</sup> About the time trends, the highest prevalence of prescription was found in the initial days, followed by gradual reduction in later months. The highest prescribing rates were found in Southeast and East Asia with lowest Europe.<sup>2</sup>

### Prevention of AR

Healthcare providers and common man require increased awareness regarding judicious use of antibiotics in pandemics as well as in normal situations. In this scenario, it is important the role of

antimicrobial stewardship programs on supporting the optimal selection of empirical therapies and the rapid de-escalation of treatment once SARSCoV-2 infection is confirmed.<sup>6</sup>

Antibiotic stewardship programs aim at refining the appropriateness of antibiotic use associated with reduced antibiotic utilization, and decreased incidence of drug-resistant infections. Considering the patterns of antibiotic prescribing in COVID-19 helps to identify openings for interventions, and target antibiotic stewardship strategies to progress the quality and safety of antibiotic use.<sup>2</sup>

### Antibiotic stewardship

The spectrum of infectious diseases is rapidly evolving. Emerging infectious agents present with a constellation of challenges. The highly virulent pathogens with increased resistance result in increased morbidity, mortality, and healthcare costs. It has been estimated that ten million people will die every year due to AMR by 2050.<sup>10</sup>

The current scientific literature emphasizes on reduction of inappropriate use of antimicrobials in all healthcare settings.<sup>1</sup> In this context, the application of antibiotic stewardship programs play a vital role.

### Definition

It is defined as “a coherent set of actions which promote using antimicrobials responsibly” based on the principle that antimicrobial treatments are limited resources and that inapt use can have serious adverse effects on the patient increasing morbidity and mortality.<sup>11</sup>

Stewardship describes the vigilant and accountable administration of something entrusted to one's care. The term antimicrobial stewardship was first applied by in 1996 by John McGowan and Dale Gerding and they suggested a causal association between antimicrobial agent use and resistance. Antimicrobial Stewardship (AMS) refers to the optimal selection, dosing, and duration of antimicrobial treatment resulting in the best clinical outcome with minimal side effects to the patients and minimal impact on subsequent resistance.<sup>12,13</sup>

Antimicrobial stewardship (AMS) defines a healthcare-system-wide approach to promoting and

monitoring the judicious use of antimicrobials to preserve their future effectiveness.<sup>3</sup> The term also indicates the monitoring the use of an antimicrobial through a standardized evidence-based approach, thereby reducing selection and spread of resistant germs and the adverse effects related to the use of antibiotics, and ultimately contain the costs.<sup>3</sup>

### Goals of AMS

According to the Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America (SHEA), the prime goal of AMS is to augment clinical outcomes for the patient and lessen consequences of antimicrobial use and antimicrobial resistance.<sup>14</sup>

The main goals include to work with healthcare practitioners encouraging to prescribe 5 “D”s of antimicrobial therapy, i.e. right Drug, correct Dose, right Drug-route, suitable Duration, timely De-escalation to pathogen-directed therapy. Other goals comprise of preventing overuse of antimicrobial drugs, its misuse, and abuse, to reduce adverse effects related to antibiotics, to minimize development of resistance thereby reducing healthcare-associated cost.

### Core elements of AMS

This includes

- Leadership commitment including formulation of formal statements aimed at improving the monitor of antimicrobial use, support education and training of staff related to stewardship, ardsip activities.
- Accountability and drug expertise where formal training in infectious disease and AMS will be given for physicians.
- Action includes implementing related policies that supports optimal antibiotic use and utilizing precise interventions to restrict antibiotic use.
- Tracking and reporting comprise of keeping track of the evaluation of both policies and outcomes to assess the impacts of improvement efforts.
- Educating prescribers on regular updates of resistance to optimise in antimicrobial prescription.

### Core members of stewardship team

In most situations, stewardship team include either

an infectious disease physician or a pharmacist or at times both. Even a hospitalist with keen interest in infectious disease can offer his service. Generally, the infection preventionist is one of the active members of the team. Interdepartmental collaboration with microbiology laboratory, hospital epidemiology, and administration is extremely helpful in managing crisis. The hospital administration team when join hands with these members can effectively control the situation to a great extent. Apart from clinicians, pharmacy workers and nurses, the IT staff along with infection prevention team and epidemiologist help in tracking, monitoring and reporting antimicrobial resistance and its adverse effect trends.<sup>16</sup>

At the grass root level, individual patients can serve as a good antimicrobial steward by using antimicrobials sensibly. Patient participation can be ensured by advising them to take antibiotics only by prescription given by practitioner and inform them not to store leftover antimicrobials.<sup>16</sup>

### Components of effective AMS

A chief component of effective and timely AMS is diagnostic stewardship, the process of prescribing and interpreting the results of diagnostic tests before initiating or continuing treatment. Use of rapid diagnostics enables early diagnosis and prompt treatment, leading to the use of precise and targeted antimicrobials, bypassing the misuse of empirical antimicrobials. To attain sustained stewardship, general public education has to be united with other AMS efforts including prospective audit and feedback (PAF), a peripheral, expert review of antibiotic therapy with their suggestions.

Apart from diagnostic stewardship, the other component is proper infection prevention and control. Averting the occurrence and spread of infections provide an effective antidote to inappropriate and unnecessary antibiotic prescriptions<sup>16</sup>.

### Conclusion

The increased prevalence of antibiotic resistance enforces the administration of antibiotic stewardship, especially in a country like India where prescription is not required for purchasing a drug. The objectives of antimicrobial stewardship are provision of better patient care, restricted antibiotic use, and availability of cost-effective health care.

## REFERENCES

1. De Sousa Oliveira, K., de Lima, L. A., Cobacho, N. B., Dias, S. C., & Franco, O. L. (2016). Mechanisms of Antibacterial Resistance. *Antibiotic Resistance*, 19–35.
2. Langford BJ, So M, Raybardhan S, Leung V, Westwood D, MacFadden DR, Soucy JR, Daneman N. Bacterial co-infection and secondary infection in patients with COVID-19: a living rapid review and meta-analysis. *Clin Microbiol Infect*. 2020 Dec;26(12):1622-1629.
3. Costantino M, Conti V, Corbi G, Iannelli AA, Marongiu F, Torsiello M, Della Vecchia A, Sellitto C, Genovese A, Moccia G, Filippelli A, De Caro F. Impact and Value of Hospital Antibiotic Stewardship: Retrospective Pre-COVID-19-Pandemic Analysis. *J Clin Med*. 2022 Jul 29;11(15):4412.
4. Urban-Chmiel, R.; Marek, A.; Stępień-Pyśniak, D.; Wieczorek, K.; Dec, M.; Nowaczek, A.; Osek, J. Antibiotic Resistance in Bacteria-A Review. *Antibiotics* 2022, 11, 1079.
5. [https://www.euro.who.int/-data/assets/pdf\\_file/0005/348224/Fact-sheet-SDG-AMR-FINAL-07-09-2017.pdf](https://www.euro.who.int/-data/assets/pdf_file/0005/348224/Fact-sheet-SDG-AMR-FINAL-07-09-2017.pdf)
6. Ruiz-Garbajosa P, Cantón R. COVID-19: Impact on prescribing and antimicrobial resistance. *Revista Española de Quimioterapia*. 2021;34(Suppl1):63.
7. Cong W, Stuart B, Alhusein N, Liu B, Tang Y, Wang H, Wang Y, Manchundiya A, Lambert H. Antibiotic Use and Bacterial Infection in COVID-19 Patients in the Second Phase of the SARS-CoV-2 Pandemic: A Scoping Review. *Antibiotics*. 2022 Jul 23;11(8):991.
8. Mayi BS, Mainville M, Altaf R, Lanspa M, Vaniawala S, Ollerhead TA, Raja A. A crucial role for antimicrobial stewardship in the midst of COVID-19. *Journal of Microbiology & Biology Education*. 2021 Mar 31;22(1):ev22i1-2285.
9. Sulayyim HJ, Ismail R, Hamid AA, Ghafar NA. Antibiotic Resistance during COVID-19: A Systematic Review. *International Journal of Environmental Research and Public Health*. 2022 Sep 21;19(19):11931.
10. de Kraker ME, Stewardson AJ, Harbarth S. Will 10 Million People Die a Year due to Antimicrobial Resistance by 2050? *PLoS Med*. 2016 Nov;13(11):e1002184.
11. Lakbar I, Delamarre L, Curtel F, Duclos G, Bezulier K, Gragueb-Chatti I, Martin-Loeches I, Forel JM, Leone M. Antimicrobial Stewardship during COVID-19 Outbreak: A Retrospective Analysis of Antibiotic Prescriptions in the ICU across COVID-19 Waves. *Antibiotics*. 2022 Oct 30;11(11):1517.
12. McGowan JE, Gerding DN. Does antibiotic restriction prevent resistance? *New Horiz*. 1996 Aug;4(3):370-6.
13. Gerding DN. The search for good antimicrobial stewardship. *Jt Comm J Qual Improv*. 2001 Aug;27(8):403-4.
14. Dellit TH, Owens RC, McGowan JE, Gerding DN, Weinstein RA, Burke JP, Huskins WC, Paterson DL, Fishman NO, Carpenter CF, Brennan PJ, Billeter M, Hooton TM, Society for Healthcare Epidemiology of America. 2007. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clin Infect Dis* 44:159–177.
15. Shrestha J, Zahra F, Cannady Jr P. Antimicrobial Stewardship. <https://www.ncbi.nlm.nih.gov/books/NBK572068/>
16. Doron S, Davidson LE. Antimicrobial stewardship. *Mayo Clin Proc*. 2011 Nov;86(11):1113-23. doi:10.4065/mcp.2011.0358. PMID: 22033257; PMCID: PMC3203003

REVIEW ARTICLE

# NOISE POLLUTION - AN UNDER DIAGNOSED POTENTIAL OCCUPATIONAL HAZARD IN DENTISTRY

## ABSTRACT

In this world of advanced technology and industrialisation, one of the biggest health hazard faced by human beings is noise pollution. The chronic inevitable exposure to noise at work places leads gradually to Noise Induced Hearing Loss (NIHL). The prevalence of this disorder would be more among dental professionals as they work in an unhealthy acoustic environment created by the noises of the dental operatory. This is a totally preventable disease when the dentists receive adequate health education and undergo regular screening tests. Along with this proper environmental and administrative controls need to be administered in the dental setting. This paper gives a review of the unaddressed health hazard noise pollution, its impacts and preventive methods in a dental environment.

**Keywords:** noise, noise pollution, dental, environment.

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## INTRODUCTION

A wrong sound, in the wrong place, at the wrong time defines the term noise.<sup>1,2</sup> The word noise roots from the Latin word “Nausea” that indicates unwanted/unpleasant/unexpected loud sound.<sup>2</sup> Noise pollution refers to emphasize the massive disharmony caused by of health hazard causing sounds generated in the modern life.<sup>1</sup>

As per the statistics projected by Centre for Disease Control (CDC), every year, at work place around 22 million workers are exposed themselves to potentially toxic levels of noise.<sup>3</sup> The Recommended Exposure Limit (REL) for job-related noise exposure according to NIOSH is 85 decibels. Meanwhile the suggested noise levels in health care facilities should be 35-40 dB(A) in the daytime and 30-40 dB(A) in the evening as per the International Noise Council and the World Health Organization.<sup>3,4,5</sup> According to the data released by the National Institute for Occupational Safety and Health (NIOSH), noise has been identified as one among the ten reasons of job related injuries or diseases.<sup>6,7</sup>

Considering the characteristics of the working environment and the service rendered, dentists and auxiliaries are at high risk of developing occupational hearing loss.<sup>8</sup>

## Consequences of noise pollution

The health-related consequences of noise pollution is primarily governed by characteristics of the sound generated (intensity and frequency), duration of exposure and individual susceptibilities.<sup>9</sup> Generally it can cause auditory and non-auditory ill effects. The major auditory effects are auditory fatigue (buzzing and whistling in the ears) and deafness (permanent or temporary depending on duration of exposure to noise). The common non auditory effects comprise of speech intervention, general annoyance, compromised efficiency and diminished productivity, physical stress associated changes like high blood pressure, high intracranial pressure, tachycardia, high breath rate, sweating as well as sleep and visual disturbances.<sup>1,10</sup>

Other physiological alterations include stimulated cardio vascular function, pituitary, and adrenal gland stimulation, increased secretion of gastric juices and compromised immune function. Also noise is considered to be an intrusive agent into one’s private space.<sup>10,11</sup>

## Noise pollution in dental environment

The inevitable chronic exposure to dental machines producing high intensity sound renders dental professionals and auxiliaries to be a vulnerable group for Noise Induced Hearing Loss (NIHL).<sup>10</sup> Just like the noise polluted environment in a dental office, the scenario at teaching hospitals is also not different. The auditory environment of teaching, educational and academic dental faculty is highlighted by higher noise levels as compared to other zones of education, as it involves the application of various noise generating equipments by multiple students at the same time.<sup>12</sup>

## Sources of noise pollution in dental environment

Various dental equipments like handpieces, air-conditioning and broadcasting systems play a role in making the environment noise polluted. Even high human voices in conversation, office music and children crying at the clinics can contribute to noise pollution.<sup>10,14</sup>

According to Garner et al. the major exposure in a dental set up include angled-design turbine handpieces, low-speed angled-design handpieces, lab electromotor handpieces, high-speed turbine handpieces, low-speed handpieces, stone mixers, lab machines, ultrasonic scalers and cleaners. Many of these machines generate sounds of 66 dB to 91 dB whereas airturbines can emit upto 100 dB.<sup>13,14</sup>

## Factors affecting noise pollution in dentistry

Equipment related factors:<sup>15,16,17,18</sup>

- type and speed of the instrument
- wearing of the instrument
- intensity of noise produced
- number of instruments operated at a time
- insufficient lubrication and turbine failure

**Personal and professional factors:**<sup>15,16,17,18</sup>

- Individual sensitivity
- years of exposure
- specialisation
- type of practice (teaching/non-teaching)
- proximity to the instrument

## Effects of noise pollution in dentistry

Other than the general auditory and non-auditory effects of noise pollution, noise directly or indirectly intervene in dentists' activities by dropping their capability to focus or pay attention, affecting their speed of work and movements. It can also result in reduced clarity of conversation and acts as an obstacle to proper communication capabilities. All these factors eventually end up in compromised work productivity of the professional.<sup>19</sup> Also it is reported that some noise generating machines used to render dental care causes potential health hazard even to patients.<sup>6</sup>

### Assessment of noise pollution

The elementary instruments used in noise assessment include

- 1) Sound Level Meter wherein the sound intensity is measured in dB or dB (A)
- 2) Octave Band Frequency Analyzer, where the noise is measured in octave bands.
- 3) Audiometer generally measures the hearing capacity. In the audiogram, the topmost zero line indicates normal hearing whereas a dip at 4000 Hz frequency shows NIHL.<sup>1</sup>

In dental literature, studies have employed decibelometer or a sound level meter with a mounted microphone (singh, kuppe) and noise dosimeter for the assessment of noise levels.<sup>21</sup>

Also Middle Ear Analyser (MEA), Pure Tone Audiometry (PTA) and Oto-Acoustic Emission (OAE) were employed by various investigators to estimate variations in the hearing thresholds among dental professionals in a dental school.<sup>23</sup> Otoscopy is yet another measurement tool.<sup>20</sup>

### Prevention of NIHL

NIHL is a radically preventable ailment. As per the recommendation of the American Dental Association Council on Dental Research in 1959, those dental professionals regularly using high-speed drills need to undertake intermittent hearing tests to screen their hearing capacity. The dental professionals are recommended to undergo regular otologic examinations and audiometric tests for the

same.<sup>15</sup> It is advised to establish Hearing Conservation Program (HCP) in noisy indoor working sites as a part of preventive protocols.<sup>24,25</sup>

The components of an operative HCP comprise of a survey on noise, engineering controls, administrative controls and use of personal hearing protectors.<sup>15</sup>

#### 1) Noise survey

The preliminary aim of this process is to identify those areas of the work place where the labourers are exposed to potentially toxic noise levels. The identification of such areas help in further development of administrative and engineering controls. 15,24,25

#### 2) Engineering controls

This step includes identification of source of noise production and methods adopted to address the issue. Sound can be controlled either at its source of production or its track of passage. The various attempts that can be tried out in dentistry include repairing or replacing the loud equipment with less noisy one, positioning the operator away from the source, implementation of materials with potential of vibration absorption and the usage of silencers, acoustic shields and barrier walls.<sup>15,24</sup>

#### 3) Administrative controls

This includes various measures like reduction of chronic exposure time by transferring the workers employed in loud noise areas to low noise areas for certain intervals and preparation of work time schedules that favour reduced exposure time. Exclusion of employees with higher susceptibility to NIHL in noisy areas is another option, but its practical feasibility is limited as this factor depends on individual susceptibility to loudness.<sup>15</sup>

#### 4) Use of hearing protectors

Hearing protector devices can be like an ear phone type/ear plug type or custom made/ disposable. An ideal one should protect the dentist from the unnecessary noise exposure by the machines he uses. At the same time the device should be designed in such a way that the dentist should be able to communicate with his patients.<sup>24</sup>

Generally earplugs are introduced into the ear canal, whereas earmuffs shield the entire external ear with the help of a sealed cup. Both these devices decrease the noise intensity by around 30-35 dB providing

least interference to communication with the patient or other personnel in the dental office.<sup>15</sup>

The Council on Dental Materials and Devices also recommends that practitioners concerned about the potential impairment should have an otologic examination and audiometric evaluation in a silent room, to assess the present situation. An audiometric evaluation should be made after a typical workday and again at the beginning of the next day to observe temporary threshold shift and apparent recovery.<sup>15,24,25</sup>

## Conclusion

As dental professionals and auxiliaries work in an inevitable high acoustic environment, measures to assess the level of noise generated and sustained need to be undertaken. This chronic exposure leads to auditory and non-auditory ill effects. Over a period of time, the involved personnel's health, health related quality of life and professional performance enter into a dropping phase. Hence considering the work related environment they should be well educated about the ill effects of noise pollution and well trained to implement measures to combat this health hazard.

## REFERENCES

1. K Park. Parks Textbook of Preventive and Social Medicine. Bhanot Publishers. 23rd edition. Page 741-3.
2. Jariwala, H.J.; Syed, H.S.; Pandya, M.J.; Gajera, Y.M. Noise Pollution & Human Health: A Review. Noise and air pollution. 2017; 3:1-4.
3. <https://www.osha.gov/noise>
4. <https://www.cdc.gov/niosh/topics/noise/default.html>
5. Vinodhkumaradithyaa A, Srinivasan M, Ananthalakshmi I, Kumar DP, Jeba Rajasekhar R V, Daniel T, Thirumalaikolundusubramanian P. Noise levels in a tertiary care hospital. Noise Health 2008;10:11-3
6. Singh S, Gambhir RS, Singh G, Sharma S, Kaur A. Noise levels in a dental teaching institute - A matter of concern!. J Clin Exp Dent. 2012;4(3):e141-5.
7. Mojarad F, Massum T, Samavat H: Noise levels in dental offices and laboratories in Hamedan, Iran. J Dent (Tehran) 2009, 6(4):181-186
8. Al Shanqiti, Afaf Mustafa, Hassan Ahmed Abugad, and Khaled Fikry Salama. "Assessment of Ambient Noise Exposure among Medical Staff in Dental Clinics Center of Dammam Medical Complex, Saudi Arabia." Journal of Ecophysiology and Occupational Health 20.3&4 (2020):120-127.
9. [https://www.euro.who.int/\\_data/assets/pdf\\_file/0008/136466/e94888.pdf](https://www.euro.who.int/_data/assets/pdf_file/0008/136466/e94888.pdf)
10. Ma K.W, Wong H.M., Mak C.M. Dental Environmental Noise Evaluation and Health Risk Model Construction to Dental Professionals. Int. J. Environ. Res. Public Health 2017,14,1084
11. Passchier Passchier-Vermeer W, Passchier WF. Noise exposure and public health. Environmental Health Perspectives. 2000; 108(suppl.1):123-31.
12. Amine, Meriem, et al. "Assessment of Noise Levels of Equipment Used in the Practical Dental Teaching Activities." International Journal of Dentistry 2021(2021).6642560:1-5.
13. Kumar, Prince, et al. "Noise pollution in dental office: Are we sheltered?." International Journal of Health & Allied Sciences.2012; 1(3):207-8.
14. Al-Omoush SA, Abdul-Baqi KJ, Zuriekat M, Alsoleihat F, Elmanaseer WR, Jamani KD. Assessment of occupational noise-related hearing impairment among dental health personnel. Journal of occupational health. 2020;62(1):e12093:1-12
15. Kadanakuppe S, Bhat PK, Jyothi C, Ramegowda C. Assessment of noise levels of the equipments used in the dental teaching institution, Bangalore. Indian J Dent Res. 2011;22(3):424-431.
16. Zubick HH, Tolentino AT, Boffa J. Hearing loss and the high speed dental handpiece. Am

J Public Health. 1980 Jun;70(6):633-5.

17. Shanbhag VL. Importance of prevention of noise production in Dental College. Arch Med Health Sci 2015;3:357-8
18. Willershausen B, Callaway A, Wolf TG, Ehlers V, Scholz L, Wolf D, Letzel S. Hearing assessment in dental practitioners and other academic professionals from an urban setting. Head & face medicine. 2014 Dec;10(1):1-7.
19. Schettini SR, Gonçalves CG. Quality of life, perception and knowledge of dentists on noise. Revista CEFAC. 2017; 19(6):782-91.
20. Dierickx M., Verschraegen S., Wierinck, E., Willems G., van Wieringen A. Noise Disturbance and Potential Hearing Loss Due to Exposure of Dental Equipment in Flemish Dentists. Int. J. Environ. Res. Public Health 2021; 18, 5617:1-13.
21. Choosong T, Kaimook W, Tantisarasant R, et al. Noise exposure assessment in a dental school. Saf Health Work. 2011;2(4):348-354.
23. Bali N, Acharya S, Anup N. An assessment of the effect of sound produced in a dental clinic on the hearing of dentists. Oral Health Prev Dent. 2007;5(3):187-91.
24. <https://dentalacademyofce.com/courses/1466/pdf/noiseinducedhearingloss.pdf>
25. Dierickx M, Verschraegen S, Wierinck E, Willems G, van Wieringen A. Noise Disturbance and Potential Hearing Loss Due to Exposure of Dental Equipment in Flemish Dentists. Int J Environ Res Public Health. 2021 May 24;18(11):5617.



## CLINICAL REPORT

# PRECISION ATTACHMENTS RETAINED REMOVABLE PARTIAL DENTURES - A CLINICAL REPORT

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### ABSTRACT

Among the numerous treatment options available to replace missing teeth, a removable partial denture with semi-precision attachment system has been well accepted and considered as a beneficial prosthesis. It integrates the features of both fixed and removable partial denture, thereby providing improved stability, retention and better cosmetic appeal. This case report discusses the use of a precision attachment to retain a maxillary bilateral distal extension removable partial denture. Precision attachments add new dimensions to conventional removable partial dentures.

**Keywords:** attachments, overdentures, hybrid dentures, snap fasteners.

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## INTRODUCTION

Prosthetic rehabilitation is a challenging clinical scenario especially in cases of patients presenting with multiple missing teeth. Precision attachments have wide applications, used in fixed removable bridge, removable partial dentures, overdentures, implant retained overdentures, and maxillofacial overdentures. The treatment modalities includes implants, removable partial denture, fixed partial denture, fixed -removable (hybrid) dentures and so on.<sup>1</sup> Because of the integration of features of both removable and fixed dentures, precision attachment is the connecting link between these two prosthetic systems.<sup>1</sup>

It is also called as frictional attachments, slotted attachments, parallel attachments, and key and keyway attachments.<sup>2</sup>

An attachment is generally defined as a mechanical device meant for fixation, retention, and stabilization of prosthesis. Precision attachments consist of

two metal components, that form an articulate joint. Precision attachment can be described as a retainer used in fixed and removable partial denture construction consisting of a metal receptacle and a closely fitting part, the former is usually contained within the normal or expanded contours of the crown of the abutment tooth, and the latter is attached to a pontic or to the denture framework. The unique design substitutes certain components of conventional clasp retained partial denture such as occlusal rest, bracing arm, and retaining arm.<sup>1</sup> This paper describes the case report where removable denture with precision attachment was used for a patient with multiple missing maxillary teeth.

## Case Report

A 60 year old female patient came to the Department of Prosthodontics, Pushpagiri College of Dental Sciences, Thiruvalla, Kerala with a chief complaint of multiple missing upper posterior teeth and inability to chew the food. She had a history of Carcinoma and underwent associated treatment including radiotherapy. On oral examination it was diagnosed as Kennedy's Class I case where, only maxillary anterior teeth were left (Figure 1). After clinical and radiographic examination a prosthetic treatment plan with an endodontic component was set up.



Figure 1: Pre-operative clinical view

Treatment plan included root canal treatment for the retained teeth and fabrication of semi precision attachment retained denture. A cast partial denture with extracoronal precision attachment was planned for maxillary bilateral distal extension arch. The diagnostic casts were studied which showed enough interocclusal space to accommodate the stud attachments. After endodontic treatment, the abutment teeth were prepared. After fabricating definitive impressions, it was ensured that the abutments prepared were temporized. Copings were placed and checked for the fit and pickup impressions were made with addition silicone material (Aquasil soft putty/regular set and Aquasil LV, Dentsply, Caulk, Germany) (Figure 2). Wax patterns were prepared for metal denture bases on refractory cast and casted

in cobalt chromium (Wironium, Bego, D 28359 Bremen, Germany) with prefabricated housings for patrix in the region of abutments (Figure 3). Metal denture bases were checked for fit (Figure 4). After recording maxillomandibular relation, try-in was done and dentures was fabricated. Copings were cemented using GIC cement (Ivoclar Vivadent AG, FL9494 Schaan/Liechtenstein).

After necessary occlusal error corrections, fabricated dentures were delivered Th artificial teeth in the RPDs were made of acrylic resin. The patient was given post insertion instructions. The subsequent visits were scheduled after 1 day, 1 week, 1, 3, 6 and 12months interval to assess the abutments and status of periodontal tissues. The results were appreciable in the subsequent visits. (Figure 5) The



Figure 2: Copings checked for fit.



Figure 3: Bisque trial



Figure 4: Metal denture base and FPD checked for fit



Figure 5: Post-operative view

patient was well satisfied with the denture throughout the period of 5 year follow up.

## Discussion

The state of edentulousness partial or complete disturbs the integrity of masticatory function and leads to poor aesthetics thereby compromising the quality of life of the patient.

The rehabilitation of partially edentulous arch is truly challenging in case of Kennedy's class I and class II situations. Due to the absence of abutment tooth in the distal aspect of edentulous area, the retention, support and stability offered by removable partial denture is questionable. The insufficient support renders the saddle area more prone for rotating both away from and towards the mucosa. Here because of clinically missing distal abutments, the treatment modality of fixed partial denture cannot be thought about. Implant supported prosthesis can be considered depending on the systemic conditions and radiographic status on the quality of alveolar bone.<sup>4,5</sup> The systemic status of the patient following oncology treatment also does not favour any invasive procedures like the introduction of implant. The affordability of the patient for implant is yet another issue. Hence after a thorough clinical and radiographic examination, weighing the benefits and risks involved, the fabrication of a cast partial denture with extra coronal precision attachment was chosen as the treatment plan. Attachment-retained cast partial dentures facilitate both aesthetic and functional replacement of missing teeth.<sup>4,5,6</sup> Clasp less design enhances better conservation of adjacent teeth. The improved fracture resistance of metal base and favourable responses of denture supporting tissues to metal base and ease in maintenance were the prime reasons to select metal as the material of choice for denture base.<sup>3</sup>

Even though titanium has better clinical properties than cobalt chromium, the material of choice for the fabrication of cast partial denture was cobalt chromium because of economic reasons. Rheins stud attachments were preferred in this case due to ease of maintenance and simpler design.<sup>3,6</sup>

The abutment selection also plays a vital role in the

prognosis of the patient. Anterior teeth have less chances of formation of infra bony defects or craters. The position and shape as well as larger periodontal attachment renders canines to provide the best proprioception among anteriors.<sup>5</sup>

Studies have shown a survival rate of 83.35% for 5 years, of 67.3% up to 15 years, and of 50% when extrapolated to 20 years.<sup>4,5,6</sup> Holst et al suggested that the effects of precision attachment on the longevity of treatment cannot be evaluated completely in vitro because in vitro studies the contributions of ridge resorption, salivary changes and occlusal equilibrium are not assessed.<sup>7</sup>

When compared to removable partial dentures, retention offered by precision attachments may be related to patient comfort, satisfaction, improved masticatory function and better distribution of occlusal loads and considerable preservation of abutment teeth. Precision attachments provide better vertical support and better stimulation to the underlying tissue through intermittent vertical massage.

The advantages of extra coronal attachments include preservation of abutment, ease of insertion and flexible design. These attachments eliminate the need for facial clasp arm and thereby improved aesthetics. Another advantage is that it can be used even when there is insufficient buccolingual width to accommodate the intraoral intracoronal attachment.<sup>8,9</sup> The design is not free from disadvantages. In certain cases, there occurs improper control of force distribution between dentulous and edentulous area. Maintenance and rebasing issues as well as break or wear are also associated with this treatment modality.<sup>8,9</sup>

Precision attachments pose a challenge in the field of technical skill. An in-depth comprehension of the bio mechanics of arches and thorough knowledge of material science is crucial in diagnosing and treating a case of precision attachment. If a proper treatment plan is made based on compliance of the patient, supported by clinical skills of dentist firmly deep rooted in clinical, scientific and technical aspects, precision attachments could serve as the best choice in terms of retention, stress distribution, function and aesthetics.<sup>2</sup>

## Conclusion

Removable partial denture with precision attachment integrates the features of both fixed and removable partial denture, thereby providing improved stability, retention and acceptable aesthetics. When planned and delivered meticulously in a suitable patient, it can enhance patient comfort, satisfaction, improved masticatory function and better distribution of occlusal loads.

## REFERENCES

1. Arti AG, Khanna G, Bhatnagar M, Markose GM, Singh S. Precision Attachments in Prosthodontics: A Review. *Int J Prev Clin Dent Res.* 2018;5:34-9.
2. Becerra G, Macentee M. A classification of precision attachments. *J Prosthet Dent* 1987;58:322-7.
3. Jayasree K, Bharathi M, Nag VD, Vinod B. Precision attachment: retained overdenture. *The Journal of Indian Prosthodontic Society.* 2012 Mar;12(1):59-62.
4. Yeung C, Leung KCM, Yu OY, Lam WYH, Wong AWY, Chu CH. Distal Extension Denture - Case Report and Overview. *Clin Cosmet Investig Dent.* 2020 Nov 10;12:493-503.
5. Burns DR, Ward JE. Review of attachments for removable partial denture design: 1. Classification and selection. *Int J Prosthodont.* 1990;3(1):98-102.
6. Burns DR, Ward JE. A review of attachments for removable partial denture design: part 2. Treatment planning and attachment selection. *Int J Prosthodont.* 1990;3(2):169-74.
7. Holst S, Blatz MB, Eitner S, Wichmann M. In Vitro wear of different material combinations of intracoronal precision attachments. *Int J Prosthodont.* 2006;19(4):330-32.
8. Jain R, Aggarwal S. Precision attachments-An overview. *IP Annals of Prosthodontics and Restorative Dentistry.* 2021 Feb 15;3(1):6-9.
9. Parameswari D, Konwar AK, Annapoorni H, and. Removable denture options in rehabilitation of missing dentition: A series of case reports. *Ann Prosthodont Restor Dent.* 2020;6(2):110-3.

## CASE REPORT

# LIP STAT

## A NEW HORIZON IN PERIODONTICS: A CASE REPORT

### ABSTRACT

Excessive gingival display (EGD) is a complex aesthetic problem which has a multitude of underlying aetiologies, therefore must be treated in a sequential manner. Recent advances have seen the introduction and usage of a novel technique called lip repositioning, either alone or in conjunction with existing methods. It can be used in certain cases as an easier, less complicated alternative to major surgical methods providing a pleasant satisfactory camouflage effect with lower morbidity. This case report presents the preparatory and surgical steps used to treat a 21-year-old female patient with EGD using lip repositioning technique as an alternative to invasive surgery with satisfactory results that has been stable for 1 months.

**Keywords:** Aesthetics, gummy smile, vertical maxillary excess, hyperactive upper lip, plastic surgery, lip repositioning surgery.

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## INTRODUCTION

A dazzling and beautiful smile can work wonders for anyone's personality. A smile is an expression denoting pleasure, joy, happiness, or amusement. No matter one's background, colour, or religion, everyone can understand what a smile is, and smiling is a universal way to express emotions. Smile aesthetics is based on numerical, physical, physiological and psychological data regarding beauty, while considering the desires of the patient. The harmony of the smile is determined by the shape, the position, and the colour of teeth and by the gingival tissues. The interactions between the teeth, the lip framework, and the gingival scaffold were identified by Garber and Salama as the three primary components that make up the essence of a smile.<sup>1</sup>

The extent of visibility of the periodontium rests on on the position of the smile line, which explains the relationship between the upper lip and the visibility of gingival tissues and teeth.<sup>3</sup> The frame of a smile is formed by the correlation of lips and smile line. Smile line is considered to be a valid and universally applicable tool to evaluate dentofacial esthetics.<sup>2</sup> It is

defined as an imaginary line following the lower margin of the upper lip and usually has a convex appearance.<sup>3</sup> According to Kokich et al 1999, smile line could be classified based on the inter relationship between the upper lip interdental and marginal gingiva [Table 1].<sup>4</sup>

The equilibrium of smile is considered to be good when the lower border of the upper lip is 1mm from the gingival margin at normal smile.<sup>3</sup> various classification has been proposed for smile by many authors, one among them is elaborated in Table 1.<sup>5</sup> The hallmark of an "ideal smile" entails the exposure of the entire length of the maxillary teeth with approximately 1-3 mm of gingival exposure.<sup>3</sup> The components of a balanced smile includes smile line, smile arc, upper lip curvature, smile symmetry, lateral negative space, smile symmetry, occlusal frontal plane and dental gingival components.

**Tjan et al 1984**, classified smile as high, medium, or low smile.<sup>4</sup> [Figure 1-3]

**Table 1: Classification of smile line**

Class	Type: Description	Evaluation
Score 0 masked	"Low smile line"	IDG: <25% visible , M: not visible, Teeth
Score 1	"Average/ideal smile line"	IDG: 25-75% visible M: Visible on individual teeth
Score 2	"High smile line"	IDG: >75% visible M: < 3mm visible
Score 3	"Very high smile line"	IDG: Completely visible M: >3 mm wide Maxillary band of gingiva visible beyond the mucogingival line "gummy smile"

IDG: interdental gingiva, MG: marginal gingiva



Figure 1: Low smile



Figure 2: Average



Figure 3: High smile

Classification of smile

The prevalence of high smile line is reported to be 10.57% to 38.9%.<sup>6-7</sup> High smile line is significantly more prevalent in women and poses a significant challenge to clinicians in various fields of dentistry.<sup>6-7</sup>

Excessive gingival display is one of the major causes of patient's embarrassment. An excessive gingival display of 4mm or more is classified as unattractive by dentist.<sup>4</sup> An imbalance in the gingiva-tooth ratio results in dominance of gingival appearance often referred to as "gummy smile." To improve the smile, the balance and harmony between all the three components of smile: lips, teeth and gingivae are integral.

Excessive gingival display (EGD), commonly referred to as gummy smile, and can be classified into four distinct types according to different exposure sites of gingiva. A continuous band of excessive gingival display (type 1 EGD) is the most common type. Excessive display of posterior gingiva (type 2), unilateral (type 3) EGD, and EGD of the anterior part (type 4) of the maxillary gingiva are the other types.<sup>8</sup>

For the proper treatment execution knowing different etiological factors owing to EGD plays a crucial role. These may be altered passive eruption, vertical maxillary excess, anterior dentoalveolar extrusion, gingival enlargements, short/ hyperactive lip, or a combination of these factors.<sup>9-10</sup> Based on the identified etiologies, various approaches could be proposed for treatment of EGD, including crown lengthening, apically repositioned flap with or without osseous reduction, Botox treatment, lip repositioning, orthodontic treatments, and orthognathic surgery.<sup>11</sup>

Lip repositioning was initially proposed by Rubinstein and Kostianovsky and later elaborated with different guidelines.<sup>12</sup> Other synonyms of lip stat includes Lip repositioning surgery, Mucosal coronally positioned flap, Mucosal strip technique, Reverse vestibuloplasty, Coronally positioned vestibule. The above conservative technique was later modified by Ribeiro-Júnior<sup>13</sup> et al and Silva et al<sup>14</sup> to maintain the labial frenum with a follow-up period of 6 months. Miskinyar et al, reported a low success rate and high recurrence rate with lip repositioning

and proposed a new technique including myectomy and partial resection of the levator labii superioris muscle.<sup>15</sup> Other, more aggressive procedures were reported with short term follow-up periods to increase predictability and prevent the possibility of relapse, including the following:

- (1) Detachment of labial muscles<sup>16</sup>
- (2) Use of a silicone implant spacer<sup>17</sup>
- (3) Lip elongation with rhinoplasty<sup>18</sup>
- (4) myotomy of the levator labii superioris using a nasal approach associated with subperiosteal dissection of gingiva and lip elongation with frenectomy.<sup>19</sup>

Botulinum toxins are yet another treatment approach with transient esthetic results and is indicated where there is hyperactivity of upper lip predisposes to gummy smile. The effect of which varies in duration from 3 to 5 months.<sup>20</sup>

The aim of the present case report was to demonstrate the clinical outcome of a novel conservative approach for lip repositioning in treatment of excessive gingival display.<sup>20</sup>

## Clinical case report

A 21 year old female patient presented to the department of Periodontics, Varakala, Trivandrum 2022 with the chief complaint of gummy smile. Her medical history was noncontributory, with no known allergies. Dental history revealed an orthodontic treatment done before 4 years. Thorough clinical and radiographic examination revealed type 1 EGD 8 and degree 2 vertical maxillary excess. In addition to the longer lower facial third, lateral cephalometric analysis confirmed the findings. Hyperactive upper lip was also noted. During her dynamic smile, the gingival display was about 5 mm in the anterior maxillary region.

Our measurements were done starting with detecting the patient's smile type by both visual inspection during the dialogue and a photo shooting session guiding the patient. The patient had a high smile line and a Duchene type of smile<sup>21</sup> that extends up to the second premolar on both sides given in (Figure 4.)





Figure 4. Duchene smile

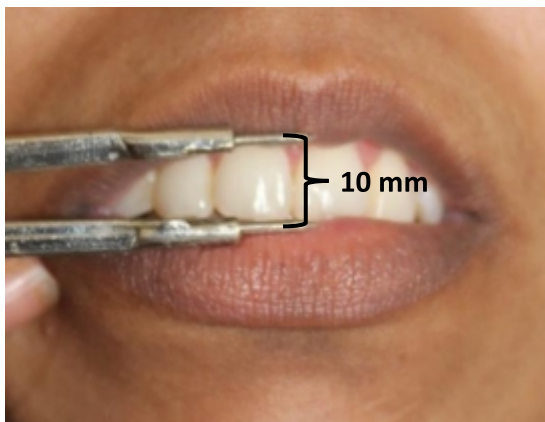


Figure 5. Interlabial distance at rest

The patient was asked to pronounce the letter “M” so that the amount of incisal exposure at rest was measured according to Sarver 2004 (Figure 5).<sup>22</sup>

The lip length at rest measured was 33mm following the guidelines given by Peck et al.1992 as shown in (Figure 6).<sup>23</sup> Also, both gingival and teeth display during full smile were measured using a periodontal probe and a caliber as shown in Figure 7 and Figure 8. The incisal edge status is a significant point to focus on and presence of attrition should be noted if present. Amount of the Keratinized attached gingiva (KAG) was measured in the periodontal chart which ranged from 5 to 7 mm. The average gingival display was verified by measurements on clinical photographs of the patients with dynamic smile. By the end of her visit, a preliminary diagnosis was explained to the patient. Analysis of the data and the interpretation of the measurements were done which lead to the confirmation of the diagnosis of Vertical Maxillary Excess (VME II) 1 and

Hypermobile Upper Lip (HUL). After the available treatment options and their associated risks and benefits were explained, the patient chose lip repositioning surgery. Informed consent was obtained from the patient according to the guidelines of

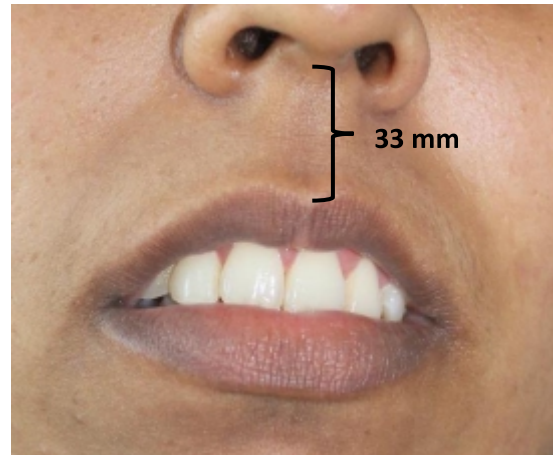


Figure 6. Lip length at rest



Figure 7. Assessing clinical crown

Gingival display (mm) 4.5-4-5-5-5-5-4.5-4



Tooth display (mm) 8-8-10-11-11-10-8-8

Figure 8: Showing gingival display and teeth from 14 to 24.

Helsinki Declaration of 1975, revised in 2013, after a detailed description of lip repositioning procedure. The importance of plaque control and maintenance care was also emphasized to the patient.

## Surgical procedures

Full mouth disinfection was done, followed by the application of topical gel. Then local anesthetic solution [Lidocaine HCl 2% with 1:100,000 epinephrine] was administered to cover the vestibule area from tooth #15 to #25. Initially markings of the incisions were done using an indelible pencil as shown in Figure 9. A partial thickness incision was made 1mm just apical to the mucogingival junction from the mesial aspect of the maxillary first premolars bilaterally. The second partial-thickness incision was made in the labial vestibule. The distance between the superior and inferior incisions was two times the initial gingival display.<sup>24</sup> Clinical judgment should be a factor based on the desired amount

of reduction in gingival display. The most important consideration is to avoid proximity of the incision line to the vermilion zone. The parallel incisions were connected in the posterior area bilaterally (Figure 9). A layer of epithelium approximately 1 mm thick was excised (Figure 10-11). Then suturing was done using the simple interrupted technique by a 3-0 vicryl absorbable suture for both anchoring and stabilizing. First suture was placed at the midline to maintain proper symmetry as shown in the Figure 12. Then, closing the gaps with stabilizing sutures to help keeping the lip in the new position coronally (Figure 13).

## Follow up and post-operative instructions

Post-operative instructions according to Humayun et al. (2010),<sup>24</sup> Rosenblatt and Simon (2006)<sup>25</sup> and Simon et al. (2007)<sup>26</sup> were explained to the patient



Figure 9. Markings of initial incisions



Figure 11. Surgical area after the removal of partial thickness flap



Figure 10. Partial thickness flap excised



Figure 12. Placement of first suture at the midline

emphasizing on minimum lip movements as much as possible. Ibuprofen 600 mg twice daily were also prescribed to the patient for 3days. Patient was instructed on using icepacks for 20minutes interval during the first 24hr. Regular oral hygiene methods were advised to stop for 2days. Chlorhexidine mouthwash 0.12% twice daily for 2weeks was given to the patient and advised to swish and spit.

### Follow up and results

At the 1st week follow up visit, the decrease in the gingival exposure by 3mm was found to be consistent and healing was reported to be satisfactory. Patient was extremely satisfied by the result. Complete healing of the surgical site was observed in the next recall on the 2nd week. No post-operative complication were reported. Patient was also advised to do lip training practices such as blowing and lip stretching exercises, 4-5 times daily. Figure



Figure 13. Placement of suture

14 and 15 shows extra oral pre-operative condition and post-operative photographs after 1 month of follow up.

### Discussion

The present case report demonstrated that there is a reduction in the gingival display achieved by about 3mm by lip repositioning technique as a less invasive method to manage EGD with a combined underlying cause of moderate VME and HUL. The technique was described as a cosmetic surgery by Rubinstein and Kostianovsky (1973)<sup>12</sup> for correction of gummy smile caused by HUL. The earlier technique was done by detaching the muscles from the bone in order to coronally position the upper lip with no reported complications. In this case we have utilized this conventional technique since this procedure doesn't have any side effects such as parasthesia as stated in the case report by Miskinyar et al 1983.

Miskinyar, et al 1983 later modified the original technique due to the occurrence of relapse which incorporated myectomy and partial resection of the Levator labii superioris instead of complete separation from the bone.<sup>15</sup> This resection was believed to reduce chances of relapse. The author also reported that one patient out of seven had post-operative paraesthesia. Later, this method was brought back into the dentistry field by Rosenblatt and Simon in 2006<sup>25</sup> and Simon et al. in 2007.<sup>26</sup> They used a partial thickness elliptical-shaped incision at the alveolar



Figure 14. Preoperative photographs (frontal and lateral view)

mucosa keeping the muscle fibers intact. They arbitrarily removed an area of 10-12 mm of mucosa with good results for a maximum follow up period of 8months.

Later, Humayun et al. (2010)<sup>24</sup> and Bhola et al. (2015)<sup>10</sup> started to implement the instructions and applied the technique to lessen the quantity of gingival display for a patient with simple VME and HUL. In their case report, Humayun et al. (2010) referred to the surgery as Mucosal Coronally Positioned Flap (MCPF) and they were the primary authors to promote the rule of “Twice the gingival display”. They were able to achieve excellent and stable results for up to 1 year.<sup>24</sup> In this case we have utilized this rule for eliminating any chance for relapse. Proper case selection and diagnosis is critical for success. Diagnosis is done following a series of examination such as facial analysis, dental analysis, lip analysis and periodontal analysis. Based on these measurements treatment plan is designed and executed. Lip repositioning procedure is indicated in cases of simple VME degree I of [2-4mm] gingival display, moderated VME degree II of [4-8mm] gingival show and in cases of HUL as advocated by the following authors, Humayun et al. (2010) and Bhola et al. (2015).<sup>10,24</sup> For this patient, the measurements revealed VME degree II since the amount of gingival display ranged between [5-6mm] according to (Garber and Salama, 1996)<sup>1</sup> classification and after calculations, the degree of lip mobility was 12mm which exceeds the normal range of [6-8m] according to Peck et al. (1992) and

McLaren and Rifkin (2002).<sup>23,27</sup> Hence, the selection of this type of surgery was suitable here.

On the other hand, lip repositioning is contraindicated with severe VME degree III of greater than 8mm gingival show according to Bhola et al. 2015<sup>10</sup> and with a limited amount of KAG or a short vestibule according to Rosenblatt and Simon et al 2006.<sup>25</sup> According to the literature, this surgical method produces satisfactory outcomes, improving the condition by 75-80% in more severe and problematic cases and by up to 100% in stable situations.

Other advantages of this procedure that are mentioned in the previous literature includes the versatility in use and various modifications which could be implemented while performing the procedure and it could also be reversed by vestibuloplasty, if the patient is not satisfied with the outcome or repeated again in case of relapse.<sup>24</sup> By incorporating a trial step after the measurements using sutures without actually cutting helps in prediction of the final outcomes.<sup>24</sup>

The main disadvantage of this technique is relapse. Relapse is seen during the first 6-8 weeks and it can be due to one of the common mistakes or conditions shown below.<sup>12,24,25.</sup>

### Causes of relapse<sup>12,24,25</sup>

1. Not following the rule of “Twice the gingival display” during the incision
2. Cutting in the KAG



Figure 15. Postoperative photographs (frontal and lateral view)

3. Using the technique in a case with limited amount of KAG
4. Cutting deep into the connective tissue and muscle fibres
5. Cases with high muscle pull

Relapse can be treated by either returning to the surgical site to remove additional mucosa as necessary or by administering Botox injections, as suggested in the following articles. Humayun et al. 2010, Bhola et al. 2015 and Rosenblatt and Simon 2006.<sup>24,10,25</sup> There are common post-operative complications range from minor discomfort and some lip movement restriction to swelling, bruising and paraesthesia. Some rare complications are also reported such as mucocele which occurs due to damage to minor salivary glands and it resolves on its own.

It is a cutting-edge predictable treatment that seems to supply significant remedies to numerous challenging cases with varied etiologies, and it need to be taken into consideration as a feasible option in periodontal plastic procedures.

## Conclusion

Gummy smile is a multifactorial condition that needs meticulous examination, to detect the causative etiologies. Within the limitations of the present study, this novel technique resulted in a successful clinical and patient centered outcome in treating excessive gingival display with various etiologies. The satisfactory result remained stable over a period of one months. The more severe the case is, the more is the need for collaborative multiple treatment modality approach.

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## REFERENCES

1. Garber DA, Salama MA. The aesthetic smile: diagnosis and treatment. *Periodontology* 2000. 1996 Jun;11(1):18-28.
2. Passia N, Blatz M, Strub JR. Is the smile line a valid parameter for esthetic evaluation? A systematic literature review. *Eur J Esthet Dent* 2011;6:314–327.
3. Narayan S, Narayan T V, Jacob PC. Correction of gummy smile: A report of two cases. *J Indian Soc Periodontol*. 2011;15(4):421-424.
4. .Kokich VO Jr, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 1999;11:311-24.
5. Tjan AH, Miller GD, The JG. Some aesthetic factors in a smile. *J Prosthet Dent* 1984;51:24–28.
6. Miron H, Calderon S, Allon D. Up- per lip changes and gingival exposure on smiling: Vertical dimension analy- sis. *Am J Orthod Dentofacial Orthop* 2012;141:87–93.
7. Kourkouta S. Implant therapy in the es- thetic zone: Smile line assessment. *Int J Periodontics Restorative Dent* 2011; 31:195–201.
8. Wu H, Lin J, Zhou L, Bai D. Classifica- tion and craniofacial features of gummy smile in adolescents. *J Craniofac Surg* 2010;21:1474-1479.
9. Robbins JW. Differential diagnosis and treatment of excess gingival display. *Pract Periodontics Aesthet Dent* 1999; 11:265-272.
10. Bhola M, Fairbairn PJ, Kolhatkar S, Chu SJ, Morris T, de Campos M. LipStaT: The lip stabilization technique-Indications and guidelines for case selection and classification of excessive gingival display. *Int J Periodontics Restorative Dent* 2015;35:549-559.
11. Bidra AS, Agar JR, Parel SM. Management of patients with excessive gingival display for maxillary complete arch fixed implant-supported prostheses. *J Prosthet Dent* 2012;108:324-331.
12. Gonzales-Medina K, Mendoza-Geng A, Vergara-Buenaventura A. The lip repositioning surgery: a review of the technique's evolution.

- European Journal of General Dentistry. 2021 Sep;10(03):176-82.
13. Ribeiro-Júnior NV, Campos TV, Rodrigues JG, Martins TM, Silva CO. Treatment of excessive gingival display using a modified lip repositioning technique. *Int J Periodontics Restorative Dent* 2013;33:309-314.
  14. Silva CO, Ribeiro-Júnior NV, Campos TV, Rodrigues JG, Tatakis DN. Excessive gingival display: Treatment by a modified lip repositioning technique. *J Clin Periodontol* 2013;40:260-265.
  15. Miskinyar S. A new method for correcting a gummy smile. *Plast Reconstr Surg* 1983;72:397-400.
  16. Litton C, Fournier P. Simple surgical correction of the gummy smile. *Plast Reconstr Surg* 1979;63:372-373.
  17. Ellenbogen R, Swara N. The improvement of the gummy smile using the implant spacer technique. *Ann Plast Surg* 1984;12:16-24.
  18. Ezquerro F, Berrazueta MJ, Ruiz-Capillas A, Arregui JS. New approach to the gummy smile. *Plast Reconstr Surg* 1999; 104:1143-1150.
  19. Ackerman MB, Ackerman JL. Smile analysis and design in the digital era. *J Clin Orthod* 2002;36:221-236.
  20. Jaspers GW, Pijpe J, Jansma J. The use of botulinum toxin type A in cosmetic facial procedures. *Int J Oral Maxillofac Surg* 2011;40:127-133.
  21. Ekman, P., Davidson, R.J., Friesen, W.V. The Duchenne smile: emotional expression and brain physiology II. *J. Pers. Soc. Psychol.* 1990; 58:342-353.
  22. Sarver DM. Principles of cosmetic dentistry in orthodontics: Part 1. Shape and proportionality of anterior teeth. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2004 Dec1;126(6):749-53.
  23. Peck S, Peck L, Kataja M. Some vertical lineaments of lip position. *American Journal of Orthodontics and Dentofacial Orthopedics.* 1992 Jun 1;101(6):519-24.
  24. Humayun, N., Kolhatkar, S., Souiyas, J., Bhola, M. Mucosal coronally positioned flap for the management of excessive gingival display in the presence of hypermobility of the upper lip and vertical maxillary excess: a case report. *J. Periodontol.* 2010;81:1858-63.
  25. Rosenblatt A, Simon Z. Lip repositioning for reduction of excessive gingival display: a clinical report. *International Journal of Periodontics & Restorative Dentistry.* 2006 Oct 1;26(5). 433-7.
  26. Simon Z, Rosenblatt A, Dorfman W. Eliminating a gummy smile with surgical lip repositioning. *The journal of cosmetic dentistry.* 2007;23(1).
  27. McLaren EA, Rifkin R. Macroesthetics: facial and dentofacial analysis. *J Calif Dent Assoc.* 2002 Nov;30(11):839-46.

## CASE REPORT

# AESTHETIC REHABILITATION OF SPACING IN MAXILLARY ANTERIORS WITH INDIRECT CERAMIC VENEER- A CASE REPORT

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### ABSTRACT

The introduction of esthetic dentistry has drastically changed the field of smile designs. Advancements in restorative techniques favors the implementation of functional and esthetical smiles. Various treatment options include esthetic space closure using composite resins, orthodontic space closure, or both. This case report discusses the management of spacing of maxillary anterior teeth using ceramic veneers.

**Keywords:** Aesthetic rehabilitation, Spacing, Veneer.

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## INTRODUCTION

Dental aesthetics plays a dynamic role in defining oral health related quality of life of an individual.<sup>1</sup> Over the years, demand for esthetic dentistry has amplified among patients enthusiastic to have a visually appealing smile. Advanced restorative materials and techniques and advocacy of concept of conservation of remaining teeth favors the implementation of functional and esthetical smiles.<sup>2</sup>

According to Steigman and Weissberg (1985), among the general population, altogether 21.4% exhibited spacing in both arches.<sup>3</sup> General causes of spacing could be hereditary, acquired or functional. Hereditary causes include tooth size-arch size discrepancies, congenitally missing teeth, macroglossia, supernumerary teeth, small teeth and hypertrophic upper lip frenum constitute the hereditary etiology whereas oral deleterious habits and pathologic conditions such as macroglossia, missing teeth, delayed teeth eruption constitute functional etiological components. Treatment depend upon the extent of spacing and peculiarities of dentition. Various treatment options include esthetic space closure using composite resins, orthodontic space closure, or both.<sup>4</sup> This case report discusses the management of spacing of maxillary anterior teeth using ceramic veneers.

As per Manuele Mancini, ceramic veneer is considered as the treatment modality in cases of abrasion, crown fracture, diastema cases, teeth defects, discoloration, cases that cannot be corrected by orthodontic treatment and to adjust occlusion.<sup>5</sup> The contraindications of this technique include bruxism and other habits, edge to edge bite and deep bite.<sup>5</sup> This case report discusses the management of spacing of maxillary anterior teeth using ceramic veneers.

## Case report

A 30-year-old female patient reported to the clinic with the chief complaint of spacing between teeth in the upper front teeth region. The medical history of the patient was non-contributory. The patient gave a dental history of incomplete orthodontic treatment. The patient underwent orthodontic treatment for

space closure few years back. Due to personal reasons, the treatment was discontinued which resulted in relapse of spacing.

Clinical examination revealed spacing in the upper anterior region with congenital missing of both maxillary lateral incisors. On examination around 2mm space was appreciated between 11 and 13. Equal amount of spacing was noted between 11, 21 and 13, 14. The dental midline was shifted to the right side of the patient with relation to the mandibular anteriors.

The patient demanded an immediate solution for the spacing in the maxillary anterior region. The patient was informed about all the treatment options. Because of the relapse, patient was not interested to take up orthodontic treatment again. Hence considering the clinical scenario and patients, choice, it was decided to close the spacing indirect veneers from canine to canine region. Although the patient had a history of discontinued orthodontic treatment, her posterior teeth were in occlusion with no deep bite of anteriors. Since the patient was only concerned about the spacing maxillary anteriors were only planned for ceramic veneering. Informed consent was obtained from the patient prior to the start of treatment.

A comprehensive intra and extraoral examination including the evaluation of both hard and soft tissues, temporomandibular joint assessment, evaluation of periodontal health and patient's occlusion. Frontal and lateral profile photographs were taken for record purpose and post treatment evaluation. (Figure 1 and figure 2) The hard tissue components like midline position, crown length and other tooth dimensions, inclinations, interdental contact area and point were assessed and recorded.

Shade selection was done using Vitapan Classical shade guide (Vita Zahnfabrik, Germany) before teeth preparation. Both the canines 13, 23 were prepared into the shape of lateral incisors whereas 14 and 24 were prepared to the shape of canine for better good esthetic appeal. (Figure 3 and figure 4)

The proximal margins were stretched out into the area of the contact point and throughout the teeth preparation, chamfer finish line of 0.5-mm-depth



was prepared using round end tapered bur.

Retraction cord (No.000) embedded in 2% lignocaine and adrenaline was inserted in the gingival sulcus and kept for few minutes. Gingival retraction cord was removed just before the impression making. Upper full arch impression was made with poly vinyl siloxane material using putty technique, followed by taking lower arch putty impression and were sent to the laboratory for fabrication of IPS- emax porcelain veneers. (Figure 5) In this case, provisional restoration was not required as the

tooth preparation was minimal and confined to enamel. Later, diagnostic wax up was made and was explained to the patient.

The fit, shade, marginal adaptation and of the veneer was assessed by individual and collective try-in. the approval of the patient was ensured during the appointment of try-in. oval was obtained at the time of try-in.

The light-cured resin cement (Metacem resin cement / META) was used for cementation. It was mixed properly and was placed on to veneers. After applying it on the teeth, it was light cured from a 5 cm-distance for 5 seconds. Afterwards, each laminate was cured for around 40 seconds. Final finishing was done with composite finishing burs. The overall results were appreciable, and the patient was very well satisfied with the final esthetic output.



Figure 1: Pre-operative frontal view



Figure 2: Pre-operative lateral view



Figure 3: During teeth preparation



Figure 4: Finished teeth preparations



Figure 5: Indirect laminate veneers

Patient was given post-operative and oral hygiene instructions. (Figure 6)

## Discussion

Along with the remarkable compressive strength, colour stability and abrasion resistance, the exceptional capacity of ceramic veneers to reproduce the optical properties tooth tissues like fluorescence, opalescence, and translucency resulted in its unique position as the main stay of managing esthetic issues. (pini)

The patient was well explained about all possible treatment options, focusing on the merits and demerits of each. The patient chose indirect ceramic veneers as the comfortable option. In the present case, even though the patient had a history of discontinued orthodontic treatment, her posterior occlusion was in favour of veneer treatment in the anteriors. The molars were well occluded, supporting the choice of veneer as the treatment modality. All possible efforts were taken to evaluate the distinct features and occlusion and to visualize the patient the esthetic result using casts and try-in.

The placement of overall chamfer preparation reduced the risk for fracture and facilitates colour build up with veneer cementation.<sup>5</sup>

In the current situation, lithium disilicate based ceramic was chosen as the material for veneer fabrication because of its reported properties like improved translucency and outstanding esthetics mimicking natural dentition.<sup>6</sup>

The clinical success of anterior space closure depends upon case selection and treatment selection. If ceramic veneers are selected in indicated cases

with implementation of appropriate techniques, remarkable rehabilitation of aesthetics can be achieved. The extent of bonding between veneer and tooth surface is vital in treatment success. In subsequent follow ups, there was neither degradation of the restoration quality nor marginal gaps or surface alterations.

## Conclusion

In the present case, management of spacing of maxillary anterior teeth using ceramic veneers is depicted. The benefits of ceramic veneer like minimal tooth preparation and better bonding of ceramic to tooth structure adds to the treatment quality.

## REFERENCES

1. James JM, Puranik MP, Sowmya KR. Self-perception of dental esthetics, malocclusion, and oral health-related quality of life among 13–15-year-old schoolchildren in Bengaluru: A cross-sectional study. *Journal of Nature and Science of Medicine*. 2022 Jul 1;5(3):262.
2. Walter RD, Raigrodski AJ. Critical appraisal: clinical considerations for restoring mandibular incisors with porcelain laminate veneers. *J Esthet Restor Dent*. 2008;20(4):276-281.
3. Steigman S, Gershkovitz E, Harari D. Characteristics and stability of spaced dentition. *Angle Orthod*. 1985;55(4):321-328.
4. Gkantidis N, Psomiadis S, Topouzelis N. Teeth spacing: etiology and treatment. *ELLENIKE ORTHODONTIKE EPITHEORESE*. 2007;10(2):75.
5. Jajoo N, Chowdhury D, Maity I, Majumdar TK. Enhancing smile with ceramic veneers two case reports. *IP Indian Journal of Conservative and Endodontics*. 2020 Sep 15;5(3):135-9.
6. Simonsen RJ, Calamia JR. Tensile bond strength of etched porcelain. *J Dent Res*. 1983;62:297.



Figure 6: Post treatment view

# ANTIBACTERIAL ACTIVITY OF GREEN TEA LEAVES AND LEAVES COMMONLY ADDED TO GREEN TEA PREPARATIONS, AGAINST COMMON PERIODONTAL PATHOGENS - AN IN VITRO STUDY

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## ABSTRACT

**Background:** Periodontal disease, a chronic inflammatory disease resulting in progressive attachment and alveolar bone loss, is, after dental caries, one of the most important oral diseases contributing to the global burden of chronic disease. India is one of the largest consumers of tea. Green tea market has been steadily increasing in India due to the proven health benefits. Various studies have shown the beneficial effects of green tea on cardiovascular diseases, obesity and type 2 diabetes mellitus. The study was conducted with an objective of evaluating the in vitro antimicrobial activity of *Camellia sinensis*, *Ocimum tenuiflorum*, *Mentha arvensis*, *Moringa olifera* and *Citrus limon* leaves on *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans*.

**Methodology:** The study was an in-vitro study. The fresh leaves of *Camellia sinensis*, *Ocimum tenuiflorum*, *Mentha arvensis*, *Moringa olifera* and *Citrus limon* were obtained and were sundried and powdered. Solvent extracts were prepared with methanol by maceration technique. Antibacterial activity was assessed using the agar well diffusion assay and minimum inhibitory concentration was assessed using the serial tube dilution technique.

**Results:** It was observed that the maximum zone of inhibition against *Porphyromonas gingivalis* was demonstrated by 0.2% chlorhexidine (positive control), followed by *Moringa olifera* and *Camellia sinensis*. Against *Aggregatibacter actinomycetemcomitans*, 0.2% chlorhexidine (positive control) demonstrated the maximum antibacterial activity, followed by *Camellia sinensis*. *Moringa olifera*.

**Conclusion:** The study showed that all the five extracts used in the study demonstrated antibacterial activity against both the periodontal pathogens.

**Key words:** *Camellia sinensis*, *Ocimum tenuiflorum*, *Mentha arvensis*, *Moringa olifera*, *Citrus limon*, *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*.

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## Background:

Infectious diseases are the third most significant reason of mortality around the world. The burden of infectious diseases is high in developing countries. This is because of the emergence of multi-drug resistant pathogens due to poor health-care facilities, and over-the-counter availability and misuse of antimicrobial agents.<sup>1</sup>

World Health Organization (WHO) has urged the search for new antimicrobial compounds and natural bioactive compounds which can be a good candidate in this perspective. The use of conventional antimicrobial agents against these infections is always associated with problems such as the development of multiple drug resistance and adverse side effects. In some cases, the use of synergistic antibiotic drug combination with bioactive compounds is the only option for the treatment of multi-drug resistant (MDR) bacteria.<sup>1</sup>

Periodontal disease, a chronic inflammatory disease resulting in progressive attachment and alveolar bone loss, is, after dental caries, one of the most important oral diseases contributing to the global burden of chronic disease, and it meets the criteria for consideration as a public health problem that requires action. Furthermore, multiple studies have reported association of periodontal disease with various systemic diseases and conditions, such as diabetes, HIV, atherosclerotic vascular disease, rheumatoid arthritis, adverse pregnancy outcomes, obesity, and metabolic syndrome. The costs of treating the periodontal disease are substantial and due to the current state of knowledge of the risk factors implicated in the etiopathogenesis of periodontal disease [e.g., smoking, alcohol, poor diet, lack of exercise, stress, distress, and psychological-coping resistance], there is sufficient information to allow the effective control of the common forms of the disease. As non-communicable chronic diseases share numerous risk factors with periodontal diseases, The Common Risk Factor Approach (CRFA) and the health promotion approach have been acknowledged as key aspects of the strategies aimed at those who are known to be at high risk.<sup>2,3</sup>

India is one of the largest consumers of tea. Green tea market has been steadily increasing in India due to the proven health benefits. Various studies have

shown the beneficial effects of green tea (*Camellia sinensis*), not only on cardiovascular diseases but also on obesity and type 2 diabetes mellitus.<sup>4</sup> Leaves such as *Ocimum tenuiflorum* (Tulsi), *Mentha arvensis* (Mint), *Moringa olifera* leaves (Drum stick) and *Citrus limon* leaves (Lemon) leaves, have been added to the commercially available green tea (or fresh leaves are used while preparation of green tea), to enhance the medicinal benefits of the preparation.

The study was conducted with an objective of evaluating the in vitro antimicrobial activity of *Camellia sinensis*, *Ocimum tenuiflorum*, *Mentha arvensis*, *Moringa olifera* and *Citrus limon* leaves on *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans*; and assessing the minimal inhibitory concentrations of the extracts against the two microorganisms.

## METHODOLOGY

The study was an in-vitro study. The fresh leaves of *Camellia sinensis*, *Ocimum tenuiflorum*, *Mentha arvensis*, *Moringa olifera* and *Citrus limon* were obtained and were sundried and powdered using a mixer grinder. All specimens will be identified by a botanist for their authenticity.

### Preparation of the extracts<sup>5</sup>

Solvent extracts were prepared with methanol by maceration technique. 10g of plant powder was thoroughly mixed with 100ml methanol for a period of 24 hours and the mixture thus obtained was filtered using a muslin cloth followed by Whatman's filter paper No.1. The filtrate thus obtained was concentrated by complete evaporation of solvent at room temperature to yield the pure extract. 100% pure solutions of crude extracts were prepared by mixing well the appropriate amount of dried extracts with an inert solvent di methyl sulfoxide (negative control).<sup>5</sup> Chlorhexidine (0.2%) was used as the positive control.<sup>6</sup>

### Agar well diffusion assay

Petri dishes containing 18ml. of blood agar supplemented with haemin and vitamin K for the

periodontal pathogens were inoculated with approximately 100ml of respective microbial strain using swab technique. Wells of 8 mm diameter were cut into solidified agar media using a sterilized standard device. 100ml of each extract were poured in the respective well and the plates were incubated at 37°C for 48 hours.<sup>5</sup> To ensure the consistency of all findings, the experiment was performed and repeated under strict aseptic conditions. The antibacterial activity of each extract was expressed in terms of the mean of diameter of zone of inhibition (in mm) produced by each extract at the end of incubation period.

### Determination of Minimum Inhibitory Concentration

The Minimum Inhibitory Concentration (MIC) is defined as the lowest concentration of the extracts capable of inhibiting the growth of the bacterium tested. In the present study, MIC was determined using 'Serial tube dilution technique'.

In this technique the tubes of broth medium, containing graded doses of compounds were inoculated with the test organisms. After suitable incubation, each tube was assessed for visible growth in terms of turbidity. MIC was calculated as the lowest concentration of the extract inhibiting the visible growth of bacterial strain using reflective viewer.<sup>5</sup>

### Statistical analysis

The diameter of inhibition zone was calculated for each group, summarised and expressed as mean  $\pm$  standard deviation. One-way ANOVA followed by Tukey's post hoc test was used for inferential analysis. p value < 0.05 was considered statistically significant.

### RESULTS

The study showed that all the five extracts used in the study demonstrated antibacterial activity against both the periodontal pathogens and hence MIC was also assessed. The results zones of inhibition created by the test products as assessed by the agar well diffusion technique is shown in Table 1 and Table 2. The minimal inhibitory concentrations of each of the test products against both the periodontal pathogens, as seen with Serial tube dilution technique is outlined in Table 3.

It was observed that the maximum zone of inhibition against *Porphyromonas gingivalis* was demonstrated by 0.2% chlorhexidine (positive control), followed by *Moringa olifera* and *Camellia Sinensis*. *Ocimum tenuiflorum* and *Mentha arvensis* showed comparable antibacterial activity and *Citrus limon* showed the least activity against *Porphyromonas gingivalis*.

Sl. No.	Scientific Name	Common Name	Zone of inhibition	ANOVA and post hoc
1	<i>Camellia Sinensis</i>	Tea plant	18 $\pm$ 0.60	F = 558.34  6>4>1>2,3>5
2	<i>Ocimum tenuiflorum</i>	Holy Basil	16 $\pm$ 0.42	
3	<i>Mentha arvensis</i>	Wild mint	16 $\pm$ 0.22	
4	<i>Moringa olifera</i>	Drumstick	20 $\pm$ 0.32	
5	<i>Citrus limon</i>	Lemon	9 $\pm$ 0.14	
6	0.2% Chlorhexidine	Positive control	22 $\pm$ 0.20	

Table 1: Antibacterial activity of the leaf extracts against *Porphyromonas gingivalis*

Against *Aggregatibacter actinomycetemcomitans*, 0.2% chlorhexidine (positive control) demonstrated the maximum antibacterial activity, followed by *Camellia Sinensis*. *Moringa olifera* and *Mentha arvensis* demonstrated comparable activity, followed by *Ocimum tenuiflorum* and *Citrus limon*.

It was observed that against *Porphyromonas gingivalis*, the least MIC was demonstrated by 0.2% chlorhexidine, followed by *Moringa olifera*, *Mentha arvensis*, *Ocimum tenuiflorum*, *Camellia sinensis* and *Citrus limon*. Against *Aggregatibacter actinomycetemcomitans*, the least MIC was seen with *Citrus limon*, followed by *Ocimum tenuiflorum*, *Mentha arvensis*, *Moringa olifera*, *Camellia sinensis* and 0.2% chlorhexidine.

## DISCUSSION

The discovery and development of medicinal plants as drugs, especially from India and some African countries has proven effective in the treatment of multi-drug resistant patterns among clinical and environmental isolates. The primary benefits of using plant-derived medicines are that they are safer than synthetic alternatives, offering profound therapeutic benefits and more affordable treatment.<sup>1</sup>

Various research conducted report the effective antimicrobial properties of *Camellia sinensis*<sup>1</sup>, *Ocimum tenuiflorum* (Tulsi)<sup>9</sup>, *Mentha arvensis* (Mint)<sup>10</sup>, *Moringa olifera* leaves (Drum stick)<sup>11</sup> and *Citrus limon*<sup>12</sup> against various bacteria and fungi.

Sl. No.	Scientific Name	Common Name	Zone of inhibition	ANOVA and post hoc
1	<i>Camellia Sinensis</i>	Tea plant	24 ± 0.45	F = 501.67 6>1>4,3>2>5
2	<i>Ocimum tenuiflorum</i> ,	Holy Basil	20 ± 0.56	
3	<i>Mentha arvensis</i> ,	Wild mint	22 ± 0.32	
4	<i>Moringa olifera</i>	Drumstick	23 ± 0.21	
5	<i>Citrus limon</i>	Lemon	18 ± 0.19	
6	0.2% Chlorhexidine	Positive control	26 ± 0.19	

Table 2:  
Antibacterial activity of the leaf extracts against *Aggregatibacter actinomycetemcomitans*

Sl. No.	Scientific Name	Common Name	<i>P. gingivalis</i> (in µ/ml)	<i>A. actinomycetemcomitans</i> (in µ/ml)
1	<i>Camellia Sinensis</i>	Tea plant	64	24
2	<i>Ocimum tenuiflorum</i> ,	Holy Basil	16	20
3	<i>Mentha arvensis</i> ,	Wild mint	4	20
4	<i>Moringa olifera</i>	Drumstick	2	23
5	<i>Citrus limon</i>	Lemon	128	18
6	0.2% Chlorhexidine	Positive control	<1	26

Table 3:  
Minimal inhibitory concentrations of the leaf extracts against the periodontal pathogens

*Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans* are among the most common pathogens responsible for periodontal infections.<sup>13</sup> Studies also indicate that the adverse cardiovascular effects from periodontal diseases are due to a few putative or high-risk bacteria including *P. gingivalis* and *A. actinomycetemcomitans*. They have also been identified as a contributory cause to atherosclerosis.<sup>14</sup>

It is considered that the ideal antibiotic used in the management of periodontal disease should be pathogen specific, allogenic and nontoxic, substantive, and it should not be in general use for treatment of other diseases, as well as inexpensive. Currently, an ideal such antibiotic does not exist. Although oral bacteria are susceptible to many antibiotics, no single antibiotic at concentrations achieved in body fluids inhibits all putative periodontal pathogens. The present antimicrobials indicted for periodontal infections include Tetracycline, doxycycline, metronidazole, amoxicillin, ciprofloxacin, macrolides and local application of chlorhexidine.<sup>15</sup>

This research focuses on the potential use of leaves that are commonly available in household, that are used together with green tea leaves in preparation of a healthy drink. Periodontal diseases being considered a public health problem globally. This research demonstrates antimicrobial activity of all the leaf extracts against the periodontal pathogens. The use of these additives with the green tea can be an intervention, targeting the 'Common Risk Factor Approach' for a healthier lifestyle, without a need for a behavioural change. Furthermore, this research can pave way to further studies with broader scope, on utilizing the antimicrobial properties towards development of newer local and systemic drug delivery systems for the treatment of periodontal disease and its impacts on the health and well-being. This can possibly contribute to the various efforts in tackling the emerging antimicrobial resistance.

The results of zones of inhibition and minimum inhibitory concentration indicate an innovation of using the leaf extracts in various forms of drug delivery, to extract its potential therapeutic benefits.

The study is a preliminary investigation to assess the antibacterial efficacy of the leaf extracts that are

commonly used in tea preparations. Further research in identifying the active ingredient is needed to tap the potential of these extracts and enhancing the pharmaceutical application. Further in vivo studies and clinical trials are needed to substantiate the application of the extracts topically and systemically. Most of these leaves are readily available plant products.

## CONCLUSION

The green tea leaf extract *Camellia sinensis* and extracts of leaves commonly added to green tea preparations, namely *Moringa olifera*, *Ocimum tenuiflorum*, *Citrus limon* and *Mentha arvensis* demonstrated antibacterial activity against *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans*. Against *Porphyromonas gingivalis*, maximum zone of inhibition against was demonstrated by *Moringa olifera* and *Camellia sinensis* followed by *Ocimum tenuiflorum*, *Mentha arvensis* and *Citrus limon*. Against *Aggregatibacter actinomycetemcomitans*, maximum antibacterial activity, was demonstrated by *Camellia Sinensis*, followed by *Moringa olifera*, *Mentha arvensis*, *Ocimum tenuiflorum* and *Citrus limon*.

## REFERENCES

1. Parvez MdAK, Saha K, Rahman J, Munmun RA, Rahman MdA, Dey SK, et al. Antibacterial activities of green tea crude extracts and synergistic effects of epigallocatechingallate (EGCG) with gentamicin against MDR pathogens. *Heliyon*. 2019 Jul;5(7):e02126.
2. Dumitrescu AL. Editorial: Periodontal Disease - A Public Health Problem. *Front Public Health* [Internet]. 2016 Jan 8 [cited 2020 Aug 29];3. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4705816/>
3. Batchelor P. Is periodontal disease a public health problem? *Br Dent J*. 2014 Oct;217(8):405–9.

4. Kim HM, Kim J. The Effects of Green Tea on Obesity and Type 2 Diabetes. *Diabetes Metab J*. 2013 Jun;37(3):173-5.
5. Subramaniam R, Simpy Mittal, Mahesh Hiregoudar, Muralikrishna K S, Sakeenabi B, Prashant G M, et al. Antimicrobial activity of antidiabetic herbs on *Porphyromonas Gingivalis*, *Aggregatibacter Actinomycetemcomitans* and *Candida Albicans* - An invitro study. *Journal of Indian Association of Public Health Dentistry*. 2011;17(1):319-24.
6. Yi. Comparative Evaluation of Antimicrobial Efficacy of Coffee Extract and 0.2% Chlorhexidine Mouthwash on the Periodontal Pathogens *Porphyromonas Gingivalis*, *Prevotella Intermedia*, *Fusobacterium Nucleatum* and *Aggregatibacter Actinomycetemcomitans*: An In Vitro Study [Internet]. [cited 2020 Aug 31]. Available from: <http://www.aihbonline.com/article.asp?issn=2321-8568;year=2016;volume=6;issue=2;spage=99;epage=103;aulast=Yi>
7. Eswar P, Devaraj CG, Agarwal P. Antimicrobial Activity of Tulsi (*Ocimum Sanctum* (Linn.)) Extract on a Periodontal Pathogen in Human Dental Plaque: An Invitro Study. *J Clin Diagn Res*. 2016 Mar;10(3):ZC53-6.
8. Yamani HA, Pang EC, Mantri N, Deighton MA. Antimicrobial Activity of Tulsi (*Ocimum tenuiflorum*) Essential Oil and Their Major Constituents against Three Species of Bacteria. *Front Microbiol* [Internet]. 2016 [cited 2020 Aug 29];7. Available from: <https://www.frontiersin.org/articles/10.3389/fmicb.2016.00681/full>
9. Agarwal P, Nagesh L, Murlikrishnan. Evaluation of the antimicrobial activity of various concentrations of Tulsi (*Ocimum sanctum*) extract against *Streptococcus mutans*: An in vitro study. *Indian Journal of Dental Research*. 2010 Jul 1;21(3):357.
10. Singh R, Shushni MAM, Belkheir A. Antibacterial and antioxidant activities of *Mentha piperita* L. *Arabian Journal of Chemistry*. 2015 May 1;8(3):322-8.
11. Abdulmoneim M. Saadabi, I.E. Abu Zaid. An In vitro Antimicrobial Activity of *Moringa oleifera* L. Seed Extracts Against Different Groups of Microorganisms. *Australian Journal of Basic and Applied Sciences*. 2011;5(5):129-34.
12. Saeb S, Amin M, Gooybari RS, Aghel N. Evaluation of Antibacterial Activities of *Citrus limon*, *Citrus reticulata*, and *Citrus grandis* Against Pathogenic Bacteria. *Int J Enteric Pathog*. 2016 Nov 15;4(4):3-37103.
13. Popova C, Dosseva-Panova V, Panov V. Microbiology of Periodontal Diseases. A Review. *Biotechnology & Biotechnological Equipment*. 2013 Jan;27(3):3754-9.
14. Bale BF, Doneen AL, Vigerust DJ. High-risk periodontal pathogens contribute to the pathogenesis of atherosclerosis. *Postgraduate Medical Journal*. 2017 Apr 1;93(1098):215-20.
15. Prakasam A, Elavarasu SS, Natarajan RK. Antibiotics in the management of aggressive periodontitis. *J Pharm Bioallied Sci*. 2012 Aug;4(Suppl 2):S252-5.

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