

Anti-Microbial Photodynamic Therapy for Gingivitis in Orthodontic Patients

¹Dr. Ekavenika Kovelakar, Senior Lecturer, Department Of Orthodontics, KIMS Dental College, Amalapuram

²Dr. Srinivas Satyanarayana Kata, MDS, Department of Orthodontics, Hyderabad

Corresponding Author: Dr. Ekavenika Kovelakar, Senior Lecturer, Department of Orthodontics, KIMS Dental College, Amalapuram.

Citation of this Article: Dr. Ekavenika Kovelakar, Dr. Srinivas Satyanarayana Kata, “Anti-Microbial Photodynamic Therapy for Gingivitis in Orthodontic Patients”, IJDSIR- March - 2020, Vol. – 3, Issue -2, P. No. 217 – 221.

Copyright: © 2020, Dr. Ekavenika Kovelakar, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Objective: The objective of the study is to know the efficacy of antimicrobial photodynamic therapy in eradicating pathogenic bacteria in patients undergoing fixed orthodontic therapy

Methodology: 30 subjects with gingivitis undergoing orthodontic treatment at Department of Orthodontics. Subjects were randomly divided in to 3 groups of 10 patients each GROUP A: Toludine blue & LED,

Group B: Methylene blue & LED ,GROUP C: LED. Initially plaque index and modified gingival index were recorded. After recording the plaque index and modified gingival index scaling was done. Toludine blue or methylene blue is applied over gingiva and exposed with LED light for 2minutes. Patients were recalled after 2 weeks and plaque index and modified gingival index were again recorded.

Results: The results of present study shows a statistically significant difference within each group before & after treatment

Conclusion: There are no additional effects as compared with conventional treatment alone. With regard to eradicating bacteria

Introduction

Gingivitis is a frequently seen consequence of fixed orthodontic therapy.



It is routinely treated through conventional methods like scaling and root planning .Recent modality for treatment of Gingivitis:

“Photodynamic Therapy”

Definition

“Photodynamic therapy is defined as an oxygen dependent photochemical reaction that occurs upon light mediated activation of a photosensitizing compound leading to generation of cytotoxic reactive oxygen species, predominantly singlet oxygen.”¹

Photodynamic therapy was first reported by Danish physician “Neils Finsen”.²

“A non invasive therapeutic modality for treatment of various infections caused by bacteria, fungi and viruses.”³

Various wavelengths of visible light are used. Origin of light as therapy in medicine and surgery are traced from antiquity to the modern day. Applications of photodynamic therapy in dentistry are growing rapidly. It is also used in treatment of oral cancer, infections and in photodynamic diagnosis of the malignant transformation of oral lesions.⁴

Mechanism of action

- PDT involves three components: Light, a photosensitizer, and oxygen. The photosensitizer is administered to the patient, and upon irradiation with light of a specific wavelength, the photosensitizer undergoes a transition from a low energy ground state to an excited singlet state. Photosensitizer decay back to its ground state with the emission of fluorescence or may undergo transition to a higher energy triplet state.⁵
 - Triplet state photosensitizer can react with biomolecules in two different pathways –type I and II.⁶
- Singlet oxygen: Electronically excited and highly reactive state of oxygen. Singlet oxygen has a short lifetime in biologic systems and a very short radius of action (0.02µm). Hence the reaction takes place within a limited space, leading to a localized response, thus it acts on localized sites without affecting distant cells or organs.

Various Light Sources Used In Photodynamic Therapy

Red light – 630nm & 700nm, depth of penetration 0.5cm to 1.5cm. Helium neon lasers - 633nm ; Gallium Aluminium - Arsenide Diode lasers – 630-690nm; Argon laser – 488-514nm.^{7,8}

Recently non-laser light source such as LED have been used as new light activators in photodynamic therapy. LED devices are more compact, portable and cost effective.

Photosensitizers

- Toluidine blue
- Methylene blue

Similar chemical & physicochemical characteristics. It stains granules within mast cells, proteoglycans & glycosaminoglycans within connective tissues. Very effective photosensitizing agents for inactivation of both gram negative & gram positive pathogenic bacteria.

Methodology: 30 subjects with gingivitis undergoing orthodontic treatment at Department of Orthodontics. Subjects were randomly divided into 3 groups of 10 patients each:

Group A: Toluidine blue & LED

Group B: Methylene blue & LED

Group C: LED

Inclusion Criteria: No systemic diseases, No use of antibiotics, Patients with Gingivitis.

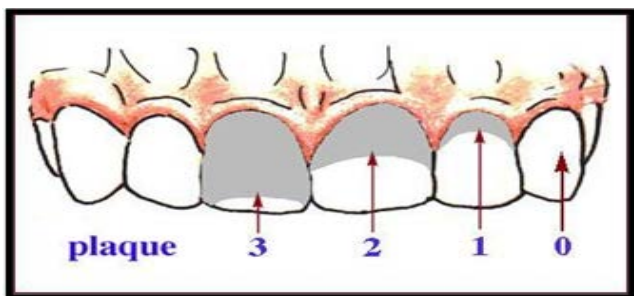
Initially plaque index and modified gingival index were recorded.

Plaque Index: Silness And Loe (1964)

The surfaces examined are four gingival areas of tooth.

- The tooth is dried and examined visually. When no plaque is visible an explorer is used to test the surface.

Scoring Criteria



- 0 No plaque
- 1 – 1/3 of tooth surface
- 2 – 2/3 of tooth surface
- 3 – More than 2/3 of tooth surface

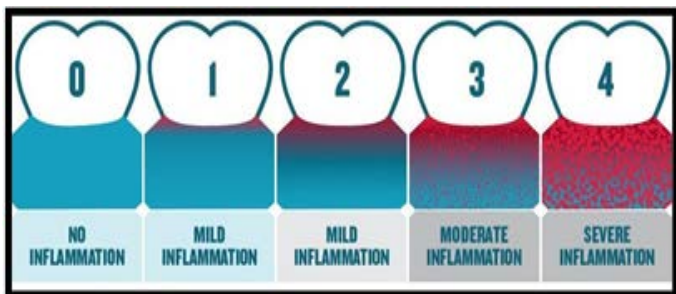
Modified Gingival Index

R.Rlobene, T.Weatherford, N.M.Ross, R.A.Lamm & L.Menaker (1986)

Method

It is a visual examination. All the surfaces of erupted teeth are examined

Scoring Criteria



- 0 :Normal
- 1 : Mild inflammation
- 2 : Mild inflammation of entire gingival unit
- 3: Moderate inflammation of gingival unit
- 4: Severe inflammation

Gingival Scores

- 0.1-1.0 = Mild gingivitis
- 1.1-2.0 = Moderate gingivitis
- 2.1-3.0 = Severe gingivitis

After recording the plaque index and modified gingival index scaling was done. Toluidine blue or methylene blue is applied over gingiva and exposed with LED light for 2minutes.



Patients were recalled after 2 weeks and plaque index and modified gingival index were again recorded

Results

Plaque Index Intra Group

Group	Time Intervals	Mean	Standard Deviation	P Value
Methylene Blue	Base	1.79	0.16	<0.0001
	2 Weeks	1.12	0.15	<0.0001
Toluidine Blue	Base	1.82	1.21	<0.0001
	2 Weeks	1.05	0.18	<0.0001
Led	Base	1.78	0.15	<0.0001
	2 Weeks	1.05	0.14	<0.0001

Plaque Index Inter Group

Group	Time Interval	Baseline		2weeks	
		Mean	S.D	Mean	S.D
Methylene Blue	Blue	1.79	0.16	1.12	0.15
Toluidine Blue		1.82	1.21	1.05	0.18
Led		1.78	0.15	1.05	0.14
P Value		0.86	0.53		

Modified Gingival Index Intra Group

Group	Time Interval	Mean	Standard Deviation	P Value
Methylene Blue	Base	1.89	0.16	<0.0001
	2 Weeks	1.09	0.32	<0.0001
Toluidine Blue	Base	1.91	1.21	<0.0001
	2 Weeks	1.41	0.38	<0.0001
Led	Base	1.90	0.12	<0.0001
	2 Weeks	1.43	0.19	<0.0001

Modified Gingival Index Inter Group:

Group	Baseline		2weeks	
	Mean	S.D	Mean	S.D
Methylene Blue	1.89	0.16	1.09	0.32
Toludine Blue	1.91	1.21	1.41	0.38
Led	1.90	0.12	1.13	0.19
P Value	0.94		0.50	

Discussion

The present study was conducted to know the efficacy of antimicrobial photodynamic therapy in eradicating pathogenic bacteria. The results of present study shows a statistically significant difference within each group before & after treatment Statistically no significant difference was observed between the 3 groups at the baseline & post treatment. Christadoulides et al evaluated that single episode of photodynamic therapy to scaling & root planning failed to result in improvement in terms of pocket depth reduction but significant reduction in bleeding scores compared to scaling & root planning.⁹

Acoording to Yilmaz et al significant clinical improvement seen with in the groups receiving scaling & photodynamic therapy.¹⁰

The reduced effectiveness of photodynamic therapy may be due to application of photodynamic therapy from external surface of gingiva. Christadoulides et al stated that frequency of photodynamic therapy is another possible explanation for the absence of clinical or microbiological differences.⁹ Chan and Lai showed that wavelength of 632.8nm (helium neon) & 665 and 830 nm (diode laser) has a high bactericidal effect on periodontal pathogens.¹¹ There is a chance that PDT does reduce the degree of periodontal inflammation.¹²

Limitations of present study

The small sample size in this study could be one of the reasons contributing to low level of significance.

Conclusion

Application of single cycle of photodynamic therapy was not effective as an adjunct to ultrasonic treatment. There are no additional effects as compared with conventional treatment alone with regard to eradicating bacteria.

References

1. Antimicrobial Photodynamic Therapy :An Overview. S.Rajesh ,Elizabeth Et Al Journal Of Indian Society Of Periodontology - Vol 15, Issue 4, Oct-Dec 2011 323.
2. Deniell MD, Hill JS. A History Of Photodynamic Therapy. Aust N Z J Surg 1991;61:340-8.
3. Kornman KS, Page RC, Tonetti MS. The Host Response To The Microbial Challenge In Periodontitis: Assembling The Players. Periodontol 2000 1997;14:33-53
4. Sharwani A, Jerjes W, Salih V, Macrobert AJ. Fluorescence Spectroscopy Combined With 5 - Aminolevulinic Acid – Induced Protoporphyrin IX Fluorescence In Detecting Oral Premalignancy J Photochem Photobiol B 2006;83:27-33.
5. Ochsner M. Photodynamic Therapy In Squamous Cell Carcinoma. J Photochem Photobial B 2001;52:42-8.
6. Foote CS. Definition Of Type I And Type II Photosensitized Oxidation. Photochem Photobiol 1991;54:659.
7. Juzeniene A, Juzenas P, Ma LW, Iani V, Moan J. Effectiveness Of Different Light Sources For 5 - Aminolevulinic Acid Photodynamic Therapy. Lasers Med Sci 2004;19:139-49.
8. Dobson J, Wilson M. Sensitization Of Oral Bacteria In Biofilms To Killing By Light From A Low- Power Laser. Arch Oral Biol 1992;37:883-7.
9. Christodoulides N, Nikolidakis D, Chondros P, Becker J, Schwarz F, Rössler R, Et Al. Photodynamic Therapy As An Adjunct To Non – Surgical Periodontal

- Treatment A Randomized Controlled Clinical Trial. J Periodontol 2008;79:1638-44
10. Yilmaz S, Kuru I, Kuru L, Noyan U, Argun D, Kadir T. Effect Of Gallium Arsenide Diode Laser On Human Periodontal Diseases; A Microbiological And Clinical Study. Lasers Surg Med 2002;30: 60-6.
11. Chan Y, Lai CH. Bactericidal Effects Of Different Laser Wavelengths On Periodontopathic Germs In Photodynamic Therapy. Laser Med Sci 2003;18:51-5.
12. Polansky R, Haas M, Heschl A, Wimmer G. Clinical Effectiveness Of Photodynamic Therapy In The Treatment Of Periodontitis. J Clin Periodontol 2009; 36: 575–580.