

**EFFICACY OF PLECTRANTHUS AMBOINICUS (INDIAN BORAGE) GEL AS AN
ADJUNCT TO SCALING IN MANAGEMENT OF PATIENTS WITH CHRONIC
GINGIVITIS**Khyati Chandra¹, Raison Thomas², Rucha Shah^{3*} and Dhoom Singh Mehta⁴¹MDS, Private Practitioner, Mumbai, India.^{2,4}MDS, Professor, Department of Periodontology, Bapuji Dental College and Hospital, Davangere, India.³MDS, Reader, Department of Periodontology, Bapuji Dental College and Hospital, Davangere, India.***Corresponding Author: Rucha Shah**

MDS, Reader, Department of Periodontology, Bapuji Dental College and Hospital, Davangere, India.

DOI: <https://doi.org/10.17605/OSF.IO/3JHRV>

Article Received on 10/10/2020

Article Revised on 30/11/2020

Article Accepted on 20/12/2020

ABSTRACT

Objectives: The present study was carried out with the aim of evaluating the antibacterial activity of *Plectranthus Amboinicus* extract by assessing its Minimum inhibitory concentrations (MIC) and Minimum bactericidal concentration (MBC) on the most common periodontal pathogens, *Porphyromonas gingivalis*(Pg), *Prevotella intermedia*(Pt), *Fusobacteria nucleatum*(Fn) and *Aggregatibacter actinomycetemcomitans*(Aa) followed by the determination of its invivo efficacy as topical gel in the management of chronic gingivitis. **Methods:** The assessment of Minimum inhibitory concentrations (MIC) and Minimum bactericidal concentration (MBC) of *Plectranthus Amboinicus* on Pg, Pt, Fn and Aa was carried out using serial dilution method. Subsequently the clinical effect of application of P Amboinicus gel as topical gel application in 24 (10 men and 14 women) chronic gingivitis patients was assessed. The test group patients were advised to use P Amboinicus Gel after scaling and these patients were examined after 21 days. The control group patients were not given any gel application and also were examined after 21 days. **Results:** The results indicated that P. Amboinicus extract was effective at concentration of 50µg/ml against four periodontopathogenic bacteria. From the MBC Values it was deduced that at there was no growth of Pg, Pt, Fn at the MIC of 50 µg/ml after inoculation into the culture media. There was minimal growth of Aa seen at the same concentration of 50 µg/ml. The results of the clinical trial indicated that from the baseline till the completion of the study at 21 days, there was statistically significant decrease recorded in plaque index, gingival index in the test group when compared to the control group (p=0.000). No patients showed any adverse reaction or reported any discomfort with the P Amboinicus gel. **Conclusion:** Topical application of *Plectranthus Amboinicus* gel played an effective role in controlling chronic gingivitis

KEYWORDS: Antibacterial activity, Minimum Inhibitory Concentration, Minimum Bactericidal Concentration, Local drug delivery, Periodontopathogenic bacteria, *Plectranthus Amboinicus* gel.

INTRODUCTION

Gingivitis is a form of periodontal disease that involves the inflammation of the gingiva and is the precursor to chronic periodontitis. It is one of the most prevalent chronic oral infection in adults. Till the time the inflammation is limited to the gingiva, it is still reversible. The uncontrolled progressive damage of collagen attachment of the tooth to the underlying alveolar bone, due to the inflammatory response of these pathogenic micro-organisms is responsible for the progressive tooth mobility and the periodontal breakdown.^[1,2]

Treatment of plaque-induced gingivitis is principally based on mechanical debridement of the tooth surface and meticulous maintenance of oral hygiene. To benefit

the patients to the maximum, adjunctive use of topical application is being used of late. Local drug delivery overcomes the disadvantages of systemic antibiotics by having a site-specific action, rapid onset of action, lesser chances of developing drug resistance and a longer duration of action.^[3-5] Since plants have enormous medicinal importance, they are being extensively explored and there is increased admiration for their use due to maximum efficiency and minimal adverse effects. Hence, there is an enormous development of natural form of therapies for the treatment of plaque induced gingivitis. *Plectranthus amboinicus* [Lour.] Spreng, also known as Indian borage, is a medicinal plant, widely used in the Indian system of medicine. It belongs to the family Lamiaceae and is also called as country borage in

English.^[6,7] It is a large succulent aromatic perennial herb found throughout India, Moluccas and Ceylon.^[8,9]

The pharmacological properties reported with *P. amboinicus* include urolithiasis, antiepileptic, anti-tumorigenic, antimutagenic, radioprotective effect, antiviral, antifungal and neuropharmacological properties.^[10-12] Owing to the non-availability of scientific literature regarding the application of *Plectranthus Amboinicus* gel in gingival and periodontal diseases, this study was undertaken. The aim of the study was to assess the clinical effectiveness of *Plectranthus Amboinicus* (Indian Borage) gel as an adjunct to Scaling and Root planing (scaling) in treatment of patients with chronic gingivitis.

MATERIALS AND METHODS

This study protocol was approved by the institutional ethical board prior to the commencement of the study. (Ref. No.BDC/EXAM/77/2017-18) The study was performed in accordance with the ethical principles as laid in the declaration of Helsinki.

Preparation of *Plectranthus Amboinicus* extract

Plectranthus Amboinicus leaves were obtained from courtyards and were dried in sunlight. The dried leaves were then powdered finely. Three hundred grams of finely powdered *Plectranthus Amboinicus* was macerated with 100% ethanol, and then be subjected to filtration with Whitman filter paper to obtain a clear filtrate. The filtrate so obtained was reduced at a low temperature of less than 60°C to obtain a solid residue of *Plectranthus Amboinicus* extract.

An invitro evaluation of the Minimum Inhibitory Concentration and Minimum Bactericidal concentration of the *Plectranthus Amboinicus* extract against the periodontopathogens *Aggregatibacter actinomycetemcomitans* (Aa), *Prevotella intermedia* (Pi), *Porphyromonas gingivalis* (Pg), and *Fusobacterium nucleatum* (Fn) was evaluated using serial dilution method. Bacterial strains used in this study were American type culture collection, Manassas, VA, USA. The tested bacterial strains in this study were Pg, ATCC 33277, Pi ATCC 25611, Fn, ATCC 25586 and Aa, ATCC 29523.

Based on the results of the invitro study, a gel form was prepared for topical oral application manner. To the prepared ethanolic extract of *Plectranthus Amboinicus* (Indian Borage), considering the previous MIC and MBC values 50 microgram/ml concentration was taken for the gel preparation. 1% w/w of carbopol 934 along with 0.5% w/w methyl paraben were added and dispersed uniformly. A 0.5N NaOH solution and glycerine was added drop wise using moderate agitation until a gel was formed. Saccharin sodium, peppermint oil and menthol was added during the gel preparation The prepared *Plectranthus Amboinicus* (Indian Borage) gel was

weighed to maintain the uniformity of the gel delivered to every patient and stored in tubes.

A single centre randomized controlled trial with a total of 24 chronic gingivitis patients (18-40 years) with gingival index score more than or equal to 2 at baseline were chosen.^[13,14] Pregnant, lactating mothers, smokers and physically challenged persons unable to maintain the oral hygiene were excluded from the study. Patients were explained in detail about the study protocol and a written consent was obtained prior to the commencement of the study. Patients were randomly divided into 2 groups by a toss of coin. The clinical parameters including plaque index and gingival index were recorded at the baseline followed by Phase-I periodontal therapy.^[13,14] In group I only scaling was performed and patients were given routine oral hygiene instructions. In group II, patients received P *Amboinicus* gel and were advised to apply & massage gel on the gingiva twice daily for 2 to 3 minutes, to continue with the regular oral hygiene measures and to report to back if any of the symptoms of irritation developed. All the patients were then recalled after 1 week and 21 days of gel application to record the clinical parameters and reinforcement of instructions and oral hygiene.

RESULTS

The results of MIC indicated that P. *Amboinicus* extract was effective at low concentration of 50µg/ml against four periodontopathogenic bacteria namely Aa,Pi,Fn,Pg. However, Pg,Fn,Pi organisms were found to be resistant at concentrations less than 0.2 µg/ml and Aa was found to be resistant at concentration less than 25 µg/ml. (Table 1).

From the MBC Values it was deduced that at there was no growth of Pg,Pi,Fn at the MIC of 50 µg/ml after inoculation into the culture media at five different concentrations which inferences that MBC values corresponded to that of MIC values. There was minimal growth of Aa seen at the same concentration of 50 µg/ml. (Table 2).

The effect of Topical *Plectranthus Amboinicus* gel in chronic gingivitis patients was evaluated by clinically evaluating the Plaque and Gingival Index reductions from baseline to 21 days of follow-up. A total of 24 (10 men and 14 women) chronic gingivitis patients (each with a single test site) who fulfilled the inclusion and exclusion criterions were selected for the study.

The mean intragroup comparisons of PI and GI values among follow ups in group I and group II were statistically significant (p=0.000, Table 3, Figure 1). There was statistically significant reduction in the Plaque index and Gingival Index between the follow-ups for both the groups between the follow ups for both the groups.

The mean intergroup comparisons for both Group I and Group II showed statistically significant reductions in the PI and GI scores from baseline to 1st and 3rd week but the difference in the Plaque index and Gingival Index

reduction was significantly higher for the test group (scaling+Gel) when compared to control (scaling alone) at the end of 3rd week that was statistically significant (p=0.000, Table 4, Figure 2).

Table 1: Minimum inhibitory concentration of P Amboinicus again common periodontopathogens at varying concentrations.

	100 µg/ml	50	25	12.5	6.25	3.12	1.6	0.8	0.4	0.2
Aa	S	S	R	R	R	R	R	R	R	R
Pi	S	S	S	S	S	S	S	S	S	R
Pg	S	S	S	S	S	S	S	S	S	R
Fn	S	S	S	S	S	S	S	S	S	R

S: Sensitive, R: Resistant

Aa: *Aggregatibacter actinomycetemcomitans*, Pi: *Prevotella intermedia*, Pg: *Porphyromonas gingivalis*, Fn: *Fusobacterium nucleatum*

Table 2: Minimum bactericidal concentration of P Amboinicus again common periodontopathogens at varying concentrations.

	100 µg/ml	50	25	12.5	6.25	3.12	1.6	0.8	0.4	0.2
Aa	200	250	R	R	R	R	R	R	R	R
Pi	NG	NG	NG	NG	NG	NG	NG	50	80	100
Pg	NG	NG	NG	NG	NG	NG	NG	NG	250	300
Fn	NG	NG	NG	NG	NG	30	50	150	210	250

Aa: *Aggregatibacter actinomycetemcomitans*, Pi: *Prevotella intermedia*, Pg: *Porphyromonas gingivalis*, Fn: *Fusobacterium nucleatum* NG: No growth

Table 3: Comparison of change in Plaque Index between Group I and Group II.

Plaque index	GROUP I		GROUP II		P VALUE
	Difference Mean±SD	% of Mean change	Difference Mean±SD	% of Mean change	
Baseline	0.19±0.00	-9.09	0.43±0.04	-19.28	0.000 S
1 week					
Baseline	0.31±0.02	-14.83	0.70±0.02	-31.39	0.000 S
3 week					
1 week	0.12±0.02	-6.32	0.27±0.06	-15.00	0.003 S
3 week					

Table 4: Mean comparison of change in gingival index between Group I and Group II.

GINGIVAL INDEX	GROUP I		GROUP II		P VALUE
	Difference MEAN±SD	% of Mean change	Difference MEAN±SD	% of Mean change	
BASELINE	0.20±0.03	-9.17	0.50±0.00	-22.22	0.000 S
1 WEEK					
BASELINE	0.35±0.03	-16.06	0.71±0.03	-31.56	0.000 S
3 WEEK					
1 WEEK	0.15±0.00	-7.58	0.21±0.03	-12.00	0.086 NS
3 WEEK					

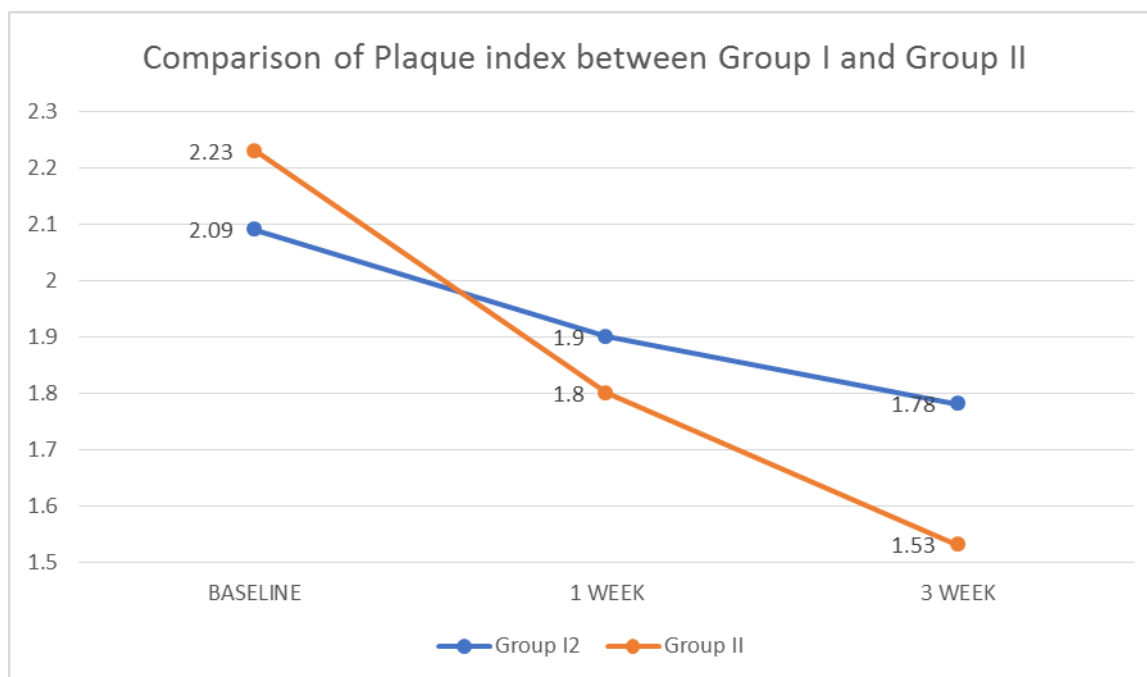


Figure 1: Comparison of Plaque index between Group I and Group II.

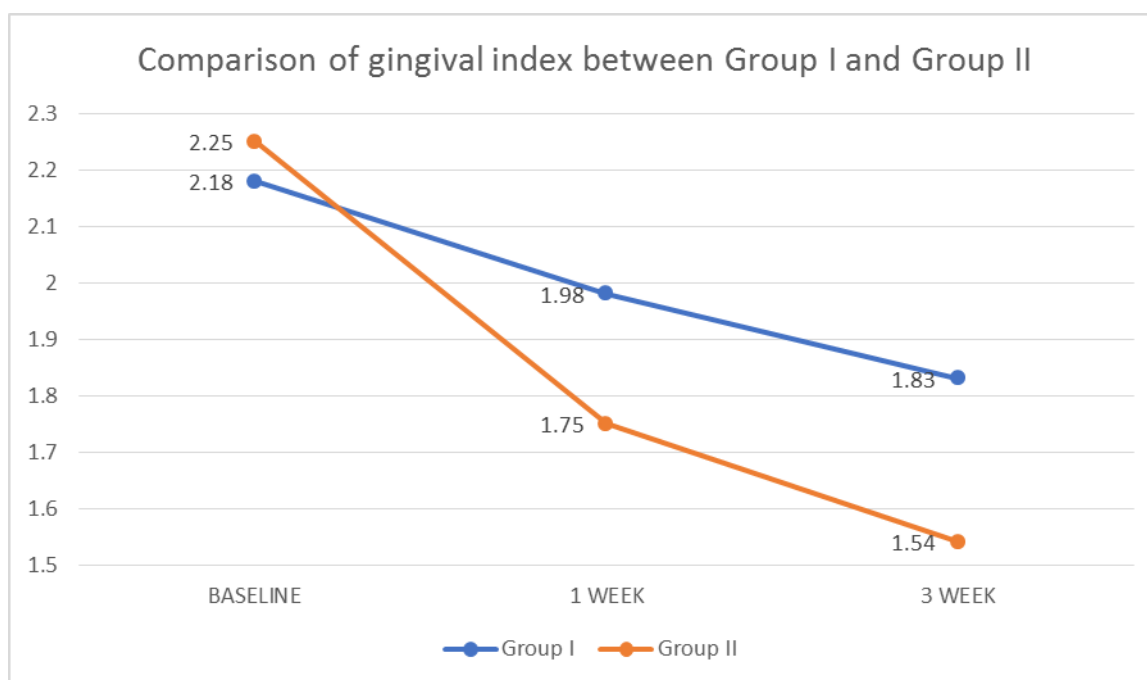


Figure 2: Comparison of Gingival index between Group I and Group II.

DISCUSSION

Dental plaque a naturally occurring biofilm is the main etiological agent for the gingivitis and may eventually lead to periodontitis if not controlled. Mechanical procedures may disrupt and remove more than 90% of organisms colonizing the tooth surface, but recolonization may start within hours and plaque may be recognized in few days. Thus, the treatment should be based on mechanical debridement, eliminating plaque retentive factors, endotoxins that play an important role for recolonization of the pathogenic microorganisms. The Consensus Report by World Workshop in

Periodontics (1996) stated that there is ample evidence convicting *A. actinomycetemcomitans* (Aa), *Porphyromonas gingivalis* (Pg), *Prevotella intermedia* (Pi), *Fusobacterium nucleatum* (Fn), *Capnocytophaga* and *Wolinella* species as causative agents for periodontal diseases.^[1]

The improved biological understanding of periodontal diseases together with the emerging evidence of bacterial specificity raises questions about the effectiveness of conventional mechanical treatment approaches in periodontal treatment and thus has led to changing the

focus and emphasis on the adjunctive agents. Regular therapeutic approaches for monitoring and handling periodontal diseases are not entirely effective. Thus, they have concentered the tactic for the usage of herbal substances as an adjuvant to mechanical therapy. Among the range of plants accredited for the medicinal worth *P. Amboinicus* is not only feasible in terms of availability but also safe, inexpensive, tremendously effective and culturally acceptable.^[15,16]

Following extensive literature exploration and to the best of our awareness, this is the first study that ascertained the invitro and invivo efficacy of *Plectranthus Amboinicus* extract against plaque induced gingival diseases. In our study, a low concentration of *Plectranthus Amboinicus* extract was demonstrated to be effective against all the 4 periodontogenic bacteria namely Aa, Pi, Fn, Pg as assessed by MIC and MBC.

During the clinical study, there was no attrition of the sample and all the cases, controls completed the entire follow up period of the study. There was statistically significant reduction in the mean PI score at baseline to 21st day in both test and control group (i.e scaling only and scaling + Gel). The difference in reduction of Plaque Index was statistically significant between the control and the test group. The clinical assessment of gingival colour, form and texture is subjective in nature whereas gingival bleeding is objective diagnostic sign of gingival inflammation and this may be observed and detected before change in colour, form or texture are manifested. The statistically significant reduction in Plaque Index can be attributed to the In this study there was statistically significant reduction in the mean Gingival index score at baseline to 21st day. Also, there was statistically significant difference between the index at 21 days between the test group and the control group. Statistically significant difference between the Gingival Index at the baseline and the 21st day signifies the potential anti-inflammatory activity of the *Plectranthus Amboinicus* extract as reported by Invitro study results revealing that *Plectranthus amboinicus* (Lour.) Spreng displayed significantly anti-inflammatory activities in the model of carrageenan-induced paw edema of mice, via inhibiting vascular permeability, which might be related to the reduction of COX-2 and TNF- α .^[18] Thus, this proved to be in favour of using *Plectranthus Amboinicus* leaf extract as a topical application gel in treatment of gingivitis as compared to scaling alone and thus, further prevention of progression into periodontitis without development of the any drug resistance and adverse reactions.

Relatively small sample size, short duration of follow up and lack of comparison to the natural product with gold standard commercial preparations reported in the literature are among the few limitations of the study. Further phytochemical and biological investigations are needed and further studies are required in formulating the Local Drug Delivery agents based upon herbs like

Plectranthus Amboinicus and assess its effectiveness in the treatment of periodontitis patients.

CONCLUSION

Within limitations of the present study, *Plectranthus Amboinicus* extract demonstrated to be effective against all the four periodontogenic bacteria namely Aa, Pi, Pg, Fn. Furthermore, the results from the topical gel application of *Plectranthus Amboinicus* illustrated statistically significant improvement in the clinical parameters (Plaque Index and Gingival Index) from baseline to 21 days. However, further multi-centre, long term, Double blinded, well controlled and randomised studies are necessary to substantiate the results obtained in the current study.

REFERENCES

1. Darout IA. Oral bacterial interactions in periodontal health and disease. *J. Dent. Oral Hyg*, 2014; 6: 51-7.
2. Consensus report. Periodontal diseases: pathogenesis and microbial factors. *Ann. Periodontol*, 1996; 1: 926-932.
3. Van Winkelhoff AJ, Rams TE, Slots J. Systemic antibiotic therapy in periodontics. *Periodontol*, 2000.1996; 10: 45-78.
4. Walker CB. The acquisition of antibiotic resistance in periodontal microflora. *Periodontol*, 2000.1996; 10: 79-88.
5. Slots J. Research, Science and Therapy Committee. Systemic antibiotics in periodontics. *J Periodontol*, 2004; 75: 1553-65.
6. Fardiaz S. Antimicrobial activity of coffee (*Coffea robusta*) extract. *ASEA Food J.*, 1995; 10: 103-106.
7. Kirtikar KR and Basu BD. "Indian Medicinal Plants," Vol. 3, International Book Distributors, Dehradun, 1999; 1970-1971.
8. P. K. Warrier and V. P. Nambier. "Indian Medicinal Plants: A Compendium of 500 Species," Vol. 4, Orient Longman Ltd., Chennai, 1996; 315.
9. Nadkarni. "Indian Materia Medica," 3rd Edition, Popular Prakashan, Mumbai, 2002; 371-72.
10. Patel R, Mahobia NK, Gendle R, Kaushik B, Singh SK. Diuretic activity of leaves of *Plectranthus amboinicus* (Lour) Spreng in male albino rats. *Pharmacognosy Res.*, 2010; 2: 86-8.
11. Likhoba CW, Simmonds MS, Paton AJ. *Plectranthus*: A review of ethnobotanical uses. *J Ethnopharmacology*, 2006; 103: 1-24.
12. Kumaran A. Antioxidant and free radical scavenging activity of an aqueous extract of *Coleus aromaticus*. *Food chemistry*, 2006; 97: 109-14.
13. Silness J, Loe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal conditions. *Acta Odont Scand*, 1964; 22: 112-34.
14. Loe H, Silness J. Periodontal disease in pregnancy. Prevalence and severity. *Acta Odontol Scand*, 1963; 21: 533-51.
15. Palombo EA. Traditional medicinal plant extracts and natural products with activity against oral

- bacteria: potential application in the prevention and treatment of oral diseases. *Evid Based Complement Alternat Med*, 2011; 2011: 680354.
16. Pillai PG, Suresh P, Aggarwal G, Doshi G, Bhatia V. Pharmacognostical standardization and toxicity profile of the methanolic leaf extract of *Plectranthus amboinicus* (Lour) Spreng. *J Applied Pharmaceutical Sci.*, 2011; 1: 75-81.
 17. Janakiraman D, Somasundaram C. Evaluation of Anti inflammatory effect of *Plectranthus amboinicus* leaf extract-An invitro study. *J Adv Pharmacy Edu & Res*, Apr-Jun. 2014; 4.
 18. Chiu YJ, Huang TH, Chiu CS, Lu TC, Chen YW, Peng WH, et al . Analgesic and antiinflammatory activities of the aqueous extract from *Plectranthus amboinicus* (Lour.) Spreng. both in vitro and in vivo. *Evid Based Complement Alternat Med*, 2012; 2012: 508137.