

A clinical study on effect of *Plantago* in gingivitis by assessing bleeding and plaque index

E. Siva Rami Reddy*, Parveen Kumar Sharma, P. Praveen Raj

Faculty of Homoeopathy, Tanta University, Sri Ganganagar, Rajasthan, India

Abstract

Background: Gingival inflammation and plaque formation are a major health problem in worldwide. **Objective:** The objective of the study was to assess the variation of parameters of bleeding and plaque index (PI) in Gingivitis before, during and after intervention with *Plantago*. **Materials and Methods:** Thirty gingivitis patients were divided into two groups: control and test groups. Subjects were instructed to use toothpaste twice daily using the bass method up to 6 months. Clinical data were assessed at baseline, 3 months and 6 months which include an analysis of PI, Gingival Index (GI) and bleeding on probing (BOP). **Results:** Over a period of 6 months, there was a significant reduction in all the clinical parameters which includes GI, PI and BOP in test group with *t*-test ($P = 0.001$). i.e., *Plantago* showed significant effect compared to the control group. Repeated-measures ANOVA also showed a significant difference ($P = 0.0001$). **Conclusion:** There is a significant mean reduction in PI, GI and BOP in gingivitis before, during and after homoeopathic treatment with *Plantago*.

Keywords: Gingivitis, Homoeopathy, *Plantago*

INTRODUCTION

The gingiva is the part of the oral mucosa that covers the alveolar processes of the jaws and surrounds the necks of the teeth. Normal gingiva covers the alveolar bone and tooth root to a level just coronal to the cemento enamel junction. The gingiva is divided into marginal, attached and interdental areas. The marginal or unattached gingiva is the terminal edge or border of the gingiva surrounding the teeth in collar-like fashion. The gingiva sulcus is the shallow crevice or space around the tooth bounded by the surface of the tooth on one side and the epithelium lining the free margin of the gingiva on the other side. The attached gingiva is continuous with the marginal gingiva. It is firm, resilient and tightly bound to the underlying periosteum of alveolar bone. The interdental gingiva occupies the gingiva embrasure. It can be pyramidal or can have a col shape. Gingiva is composed of the overlying stratified squamous epithelium and the underlying central core of connective tissue. Functions and features of gingival epithelium are mechanical, chemical, water and microbial barrier signalling functions. The major components of the gingival connective tissue are collagen fibres (about 60% by volume), fibroblasts (5%), vessels, nerves and matrix (about 35%). The gingival fibres are

arranged in three groups. That is gingivodental, circular and transcepta.^[1]

Pathologic changes in gingivitis are associated with the presence of oral microorganisms attached to the tooth and perhaps in or near the gingival sulcus. These organisms are capable of synthesising products that cause damage to epithelial and connective tissue cells as well as to intercellular constituents such as collagen, ground substance and glycocalyx.^[2-4] Morphologic and functional changes in the gingiva during plaque accumulation have been thoroughly investigated, especially in beagle dogs and in humans.^[5-7] Gingivitis has initial lesion,^[8-10] early lesion^[11,12] and established lesion.^[13-16]

The earliest signs of gingival inflammation preceding established gingivitis are increased gingival crevicular fluid

***Address for correspondence:** Dr. E. Siva Rami Reddy,

Department of Practice of Medicine, Sri Ganganagar Homoeopathic Medical College, Hospital and Research Center, Tanta University Campus, Near Ricco, New Hanumangarh Road, Sri Ganganagar - 335 002, Rajasthan, India.

E-mail: dr.sivaramireddy@gmail.com

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production rate and bleeding from the gingival sulcus on gentle probing.^[17,18] Probing pocket depth measurements by themselves are of limited value for the assessment of the extent and severity of gingivitis. Gingival bleeding on probing (BOP) indicates an inflammatory lesion both in the epithelium and in the connective tissue that exhibits specific histologic difference compared with healthy gingiva.^[19] The scoring was done on all the teeth of maxillary and mandibular arch. Plaque was assessed on distofacial, facial, mesiofacial and lingual surfaces. A mouth mirror and a dental explorer were used after air drying of the teeth to assess plaque.

India has a very long history of using herbal drugs as the main course therapy for treating a number of diseases. The herbal drugs have made their importance felt in the past few decades whose prevalence is continuously increasing in both developing and developed countries due to their natural origin and lesser side effects. *Plantago* is the most commonly used medicine in Europe, Japan and North America. In India, it is found in temperate and alpine Himalayas, Assam, Konkan, Western Ghats and Nilgiris. In Hindi, it is known as Luhuriya. It is a perennial herb with an erect stout rootstock. Leaves alternate, radical, 2.5–12.5 cm long, ovate or ovate-oblong, obtuse or subacute, entire or toothed, nearly glabrous, base tapering and decurrent into the petiole, 3–7 (commonly 5) nerved. Flowers scattered or crowded in long slender rather lax spikes, 5–15 cm long, bracts 1.5–2 m long, shorter than the calyx, broadly ovate-oblong, obtuse or subacute with broad scarious margins. Fruit is like a capsule ovoid 3–4 mm long, glabrous. Seeds are 4-8 angled, rugulose, dull black, 0.85 mm long. It contains iridoids such as aucubin, flavonoids, tannins, plant acids and mucilage.

Homoeopathic drug *Plantago* is made from the whole plant. It was proved by Dr. Alfred Heath. It has a considerable clinical reputation in the treatment of earache, toothache and enuresis. The seeds act as tonic and stimulant and are a useful remedy for dysentery. Leaves and roots are astringent and also used in fever. The leaves are applied to bruises. It is used in case of earache and sensitivity of teeth to touch. Toothache is better while eating, profuse flow of saliva. It is also used for itching, burning, urticaria, chilblains, nocturnal enuresis, in ears. Neuralgic earache and pain go from one ear to other through the head. Otagia along with toothache. Nose discharges liquid, yellow in sudden onset.^[20]

Greek physician described the traditional use of *Plantago* in wound healing in the first century AD.^[21] This plant enhances the production of nitric oxide and tumour necrosis factor alpha, which protect the host against the development of infection and tumours. This tumour necrosis factor alpha is one of the essential mediators of host inflammatory responses in natural immunity.^[22] Whole plant is used as an anti-inflammatory, antiulcer, anaesthetic and analgesic.^[23] In a study, endotoxin-free methanol extract of *Plantago major* leaves, at doses of 50, 100, 250 and 500 mg/ml, was examined for immunoenhancing properties. This result showed that this plant possessed immunomodulatory activity.^[24] For this reason, this study set out to investigate the efficacy of *Plantago* whole plant in the reduction of plaque and gingivitis^[25] in subjects with established gingivitis.

MATERIALS AND METHODS

Period of study

The study was conducted on the cases available from December 2016 to June 2017.

Place of study

The present study was carried out in the Department of Practice of Medicine (Dental) at Sri Ganganagar Homoeopathic Medical College, Hospital and Research Center, Rajasthan, India.

Sample size

Thirty patients (15 males and 15 females with a mean age of 28.8 ± 3.28 and range between 18 and 36 years) were enrolled in this study. The eligibility criteria were: age more than 18 years with a minimum of 15 teeth and the presence of established gingivitis [Figures 1 and 2].

Exclusion criteria

- The presence of systemic disease
- Antibiotic therapy for periodontitis or gingivitis
- Pregnancy
- Breastfeeding
- Alcoholic
- Smoking
- Use of orthodontic appliances
- Continuous use of mouth rinses containing chemical agents
- Any history of allergies to herbal medicines.



Figure 1: Beginning of treatment

Inclusion criteria

- Both sexes aged between 18 and 36 years
- Cases of gingivitis.

Verbal and written informed consent was obtained from all the subjects.

Method

Thirty gingivitis patients (15 test group and 15 controlled group) were included in this clinical study. These thirty cases were allocated randomly using coin toss method. Local Ethical Committee permission was taken and diagnosis was made according to dental clinical history with necessary investigations. The *Plantago* extract toothpaste was prescribed for the above cases and followed for a period of 6 months (December 2016 to June 2017). The data were presented according to standardised case record.

Remedy used

Plantago brought from a registered herbal medicine shop (Rajasthan herbal shop, Sri Ganganagar, India) and specimen was deposited in the Department of Pharmacy, Tanta University, Sri Ganganagar, Rajasthan, India. The extracts were isolated by maceration of *Plantago* with ethanol. After filtering and drying the extract, toothpastes containing 5% *Plantago* extract were prepared which is used for the test group. Commercially available toothpaste in a label-free tube was used for the control group which is alcohol free.

Patients were supplied with the assigned oral hygiene kit, toothpaste and a soft-bristled toothbrush. All the patients were instructed to use the oral hygiene items. They were asked to brush their teeth twice daily using the bass technique for approximately 1–3 min.

Follow-up and symptomatic assessment

The baseline plaque, gingival and bleeding indices^[26,27] were measured on all teeth at the buccal, mesial, distal and lingual aspects, with the exception of third molars.

This study was conducted over a period of 6 months. Clinical follow-up was performed at the end of 3 months and 6 months after initial use of *Plantago*. Throughout the study, all measurements, instrumentations and clinical data were collected by the investigator.

Statistical analysis

The collected data were analysed by mean, standard deviation and analysis of variants (ANOVA).

Research hypothesis

There is a significant reduction of parameters of PI, Gingival Index (GI) and BOP in gingivitis before, during and after homoeopathic *Plantago* herbal toothpaste

Null hypothesis

There is no a significant reduction of parameters of PI, GI and BOP gingivitis before, during and after homoeopathic *Plantago* herbal toothpaste.

RESULTS

Baseline data for control (Group I) and test groups (Group II) were analysed on a subject wise basis as shown in Table 1. Baseline demographic characteristics were tested using the independent *t*-test. They were found to be similar and no statistically significant difference existed between the groups [Table 1]. Mean \pm SD baseline data, PI is 1.72 ± 0.07 , GI is 1.9 ± 0.14 and BOP is 1.8 ± 0.43 . In *Plantago* group, PI is 1.73 ± 0.08 , GI is 1.9 ± 0.12 and BOP is 1.87 ± 0.37 . Thirty diagnosed cases of gingivitis complaints were studied for a period of 6 months. PI, GI and BOP checked in every 3 months and 6 months (before, during and after the treatment).

PI in placebo group (baseline) was 1.72 ± 0.07 , after 3 months placebo group 1.62 ± 0.09 and after 6 months 1.51 ± 0.103 . Baseline of PI is 1.73 ± 0.08 (before), after *Plantago* application within 3 months 1.29 ± 0.09 (during) and after 6 months 1.87 ± 0.37 . *P* value showed in 3 months and after 6 months was 0.0001 [Table 2].

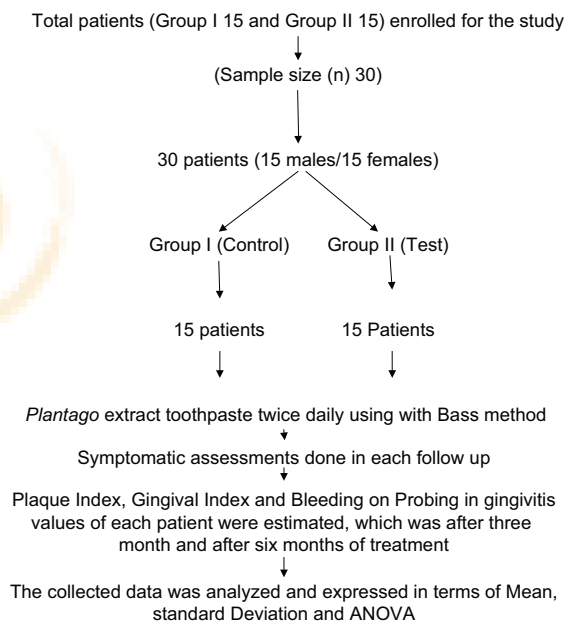


Figure 2: Flowchart: Study design

Table 1: Baseline data (n=30)

Baseline data	Baseline of characteristic study		P
	Placebo (n=15)	Plantago (n=15)	
Age (mean \pm SD)	51.2 \pm 4.38	52.2 \pm 5.71	0.571
Gender (%)			
Male	9 (60)	10 (66.6)	0.75
Female	6 (40)	5 (33.33)	0.75
PI (mean \pm SD)	1.72 \pm 0.07	1.9 \pm 0.14	0.87
GI (mean \pm SD)	1.73 \pm 0.08	1.9 \pm 0.12	0.91
BOP (mean \pm SD)	1.8 \pm 0.43	1.87 \pm 0.37	0.98

SD: Standard deviation; GI: Gingival index; PI: Plaque index; BOP: Bleeding on probing

GI of placebo group in baseline is 1.9 ± 0.014 , after 3 months is 1.80 ± 0.15 and after 6 months is 1.71 ± 0.141 . In baseline of GI is 1.9 ± 0.12 (before), after *Plantago* application within 3 months 1.34 ± 0.13 (during) and after 6 months 1.27 ± 0.111 . *P* value showed in 3 months and 6 months was 0.0001 [Table 2]. BOP of placebo group in baseline is 1.8 ± 0.43 , after 3 months is 1.73 ± 0.35 and after 6 months is 1.57 ± 0.497 . However, baseline of BOP is 1.87 ± 0.37 (before), after *Plantago* application within 3 months 1.35 ± 0.28 (during) and after 6 months 1.18 ± 0.26 . *P* value showed in 3 months and after 6 months of BOP was 0.0001 [Table 2].

Repeated-measures ANOVA was performed comparing data obtained at baseline, at 3 months and 6 months, which also revealed significant difference between the two groups, both in PI ($F = 14.0226$), $P = 0.0001$, GI ($F = 71.0768$), $P = 0.0001$ and BOP ($F = 70.8665$), $P = 0.0001$, which denotes a significant reduction in all the clinical parameters which includes GI, PI and BOP at baseline, 3 months and 6 months after homoeopathic administration with *Plantago* in gingivitis [Table 2].

DISCUSSION

It was observed that there was a significant reduction before, during and after in PI, GI and BOP values in *Plantago* group (Group II). Until now, local application of drug therapy has not been widely used in patients with gingivitis. In this study, we examined a dastifrice form containing plants' extracts to evaluate its effects on gingivitis. The results of this study suggest that the *Plantago* is safe and effective in the treatment of gingivitis as compared to the placebo group [Figure 3].

There was mild reduction in the PI, GI and BOP in the control group when compared to the test group of regular twice daily toothbrushing. Some studies have demonstrated that different formulations of chlorhexidine as mouthwash, collagen gel and toothpaste are effective in treating gingivitis. In the present study, we designed a different formulation of *Plantago* extract in the toothpaste base as a vehicle. We believe that the application of toothpaste is compatible with daily activities and patients will find its application convenient. The main advantage of the study is patient compliance and the low risk of systemic side effects.

Table 2: Gingivitis changes in the three groups over different points in time

Group (s)	PI (mean ± SD) ^ε			Within group*		Between groups [#]	
	Baseline	At 3 months	At 6 months	F	P	F	P
<i>Plantago</i> (n=15)	1.73±0.08	1.29±0.09	1.51±0.103	137.89	0.0001	14.0226	0.0001
Placebo (n=15)	1.72±0.07	1.62±0.09	1.22±0.0089	20.27	0.0001		
<i>P</i>	0.87 (NS)	0.0001	0.0001				
Group (s)	GI (mean ± SD) ^ε			Within group*		Between groups [#]	
	Baseline	At 3 months	At 6 months ^ε	F	P	F	P
<i>Plantago</i> (n=15)	1.9±0.12	1.34±0.13	1.27±0.111	120.6563	0.003708	71.0768	0.0001
Placebo (n=15)	1.9±0.014	1.80±0.15	1.71±0.141	6.41	0.003708		
<i>P</i>	0.91 (NS)	0.0001	0.0001				
Group (s)	BOP (mean ± SD) ^ε			Within group*		Between groups [#]	
	Baseline	At 3 months	At 6 months	F	P	F	P
<i>Plantago</i> (n=15)	1.87±0.37	1.35±0.28	1.18±0.26	20.37	0.003708	70.8665	0.0001
Placebo (n=15)	1.8±0.43	1.73±0.35	1.57±0.497	1.82	0.173574		
<i>P</i>	0.98 (NS)	0.003	0.00126				

*Repeated measures ANOVA was carried out with time as factor to show any difference in each group, [#]Repeated measures ANOVA was carried out with time as factor versus group for showing difference between the groups, ^εIndependent *t*-test was carried out for showing the difference between the groups at each time point. GI: Gingival index; PI: Plaque index; BOP: Bleeding on probing; NS: Not significant; SD: Standard deviation; ANOVA: Analysis of variants



Figure 3: After 6 months of treatment

The periodontal infections cause serious damage to gums. Its leads to loss of alveolar bone as well as loss of teeth. The antibacterial activity of medicinal plant against anaerobic and facultative aerobic bacterial present in the oral cavity that often causes periodontal infections is very scarce. Therefore, it is suggested that more studies must be designed to find out the exact antibacterial/anti-inflammation effects of *Plantago* on gingivitis. The reviews also recommended that further pragmatic trails including clinical trials and observational studies been conducted.

CONCLUSION

The clinical study showed significant reduction of PI, GI and BOP of gingivitis parameters with *Plantago* toothpaste.

Limitations

The sample size is small ($n = 30$) and duration only 6 months.

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Conflicts of interest

None declared.

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रक्तस्राव और प्लाक सूचकांक का आंकन कर मसूड़ाशोथ में प्लांटैगो के प्रभाव पर एक नैदानिक अध्ययन

सार

पृष्ठभूमि: मसूड़ाशोथ में मसूड़ा संबंधित सूजन और प्लाक विन्यास, बढ़ती उम्र वाली कुल जनसंख्या में 10–35 प्रतिशत लोगों में एक प्रमुख स्वास्थ्य समस्या है।

उद्देश्य: मसूड़ाशोथ में रक्तस्राव और प्लाक इंडेक्स के पैरामीटर्स की विविधता का आकलन करने के लिए प्लांटैगो के साथ पूर्व, दौरान और बाद में अंतःक्षेप।

सामग्री और विधि: कुल 30 मसूड़ाशोथ रोगियों को 2 समूहों में विभाजित किया गया: नियंत्रण और परीक्षण समूह। रोगियों को छह महीने तक बॉस विधि का उपयोग कर दिन में दो बार टूथपेस्ट उपयोग करने का निर्देश दिया गया। नैदानिक आकड़ों का मूल्यांकन बेसलाइन, 3 महीने और 6 महीने में किया गया, जिसमें प्लाक इंडेक्स, गिंगिवल इंडेक्स और प्रोबिंग पर रक्तस्राव का विश्लेषण शामिल था।

परिणाम: 6 महीने की अवधि में, सभी नैदानिक मानकों में महत्वपूर्ण कमी आई, जिसमें टी परीक्षण (पी=0.001) के साथ परीक्षण समूह में जांच पर गिंगिवल इंडेक्स, प्लाक इंडेक्स और रक्तस्राव शामिल है। प्लांटैगो ने नियंत्रण समूह की तुलना में महत्वपूर्ण प्रभाव दिखाया। दोहराए गए मापों एनोवा ने भी महत्वपूर्ण अंतर दिखाया (पी=0.0001)।

निष्कर्ष: प्लांटैगो के साथ होम्योपैथिक उपचार से पूर्व, उसके दौरान और बाद में, मसूड़ाशोथ में जाँच पर प्लाक इंडेक्स, गिंगिवल इंडेक्स और रक्तस्राव में एक महत्वपूर्ण औसत कमी देखी गई है।

Une étude clinique sur l'effet du *plantain* (*Plantago*) dans le traitement de la gingivite fondée sur l'évaluation des indices de saignement et de plaque

Résumé

Contexte: La gingivite, caractérisée par une inflammation de la gencive et la formation de plaque, est un problème de santé majeur chez les personnes âgées, touchant entre 10% à 35% de la population mondiale. **Objectif:** Évaluer les variations des paramètres des indices de saignement et de plaque en cas de gingivite avant, pendant et après le traitement avec le *Plantain*.

Matériels et méthodes: 30 patients atteints de gingivite ont été répartis en 2 groupes, le groupe témoin et le groupe test. Il a été demandé aux patients de se brosser les dents avec un dentifrice deux fois par jour en utilisant la méthode de Bass pour une période allant jusqu'à 6 mois. Les données cliniques ont été évaluées au début de l'étude, après 3 mois et après 6 mois. L'évaluation a également porté sur une analyse de l'indice de plaque, de l'indice gingival et du saignement au sondage. **Résultats:** Une réduction significative de tous les paramètres cliniques, y compris de l'indice gingival, de l'indice de plaque et du saignement au sondage, a été constatée sur une période de 6 mois chez le groupe test avec test *t* ($P=0,001$). Le *Plantain* a démontré avoir un effet important par rapport au groupe témoin. L'ANOVA (analyse de la variance) à mesures répétées a également montré une différence significative ($P = 0,0001$). **Conclusion:** Une réduction significative de la moyenne de l'indice gingival, de l'indice de plaque et du saignement au sondage a été constatée chez les patients atteints de gingivite avant et après le traitement homéopathique avec le *Plantain*.

Estudio clínico en el efecto de *Plantago* en la gingivitis evaluada con el Índice de sangrado y el Índice de placa

Resumen

Fundamento: La inflamación gingival y la formación de placa en la gingivitis es un problema de salud importante en más del 10 % al 35% de la población mundial.

Objetivos: Evaluar la variación de los parámetros de sangrado y el índice de placa en la gingivitis antes, durante y después de la intervención con *Plantago*.

Materiales y métodos: Se dividió a un total de 30 pacientes con gingivitis en dos grupos: grupo de control y grupo de estudio. Se indicó a los pacientes utilizar una pasta de dientes dos veces al día aplicando el método Bass durante seis meses. Los datos clínicos se evaluaron al principio, así como a los 3 y 6 meses. Se efectuó un análisis del índice de placa, el índice gingival y el sangrado al sondaje.

Resultados: Durante un periodo de 6 meses, se produjo una reducción de todos los parámetros clínicos que incluyeron el índice gingival, el índice de placa y el sangrado al sondaje en la prueba *t* ($P=0.001$). *Plantago* mostró el efecto significativo en comparación con el grupo de control. Los parámetros repetidos ANOVA también mostraron una diferencia significativa ($P = 0,0001$).

Conclusiones: Se produjo una reducción media significativa del índice de placa, el índice gingival y el sangrado al sondaje en la gingivitis durante y después del tratamiento homeopático con *Plantago*.

Eine klinische Studie über die Wirkung von Plantago bei Gingivitis mittels Beurteilung der Blutung und des Plaque Index

Abstrakt

Hintergrund: Zahnfleischentzündung und Plaquebildung bei Gingivitis im Alter ist ein großes Gesundheitsproblem bei mehr als 10% bis 35% der Bevölkerung weltweit.

Ziel: Die Beurteilung der Variation der Parameter von Blutungen und Plaque-Index bei Gingivitis vor, während und nach der Behandlung mit Plantago.

Material und Methoden: Insgesamt wurden 30 Patienten mit Gingivitis in zwei Gruppen eingeteilt: Kontrollgruppe und Testgruppe. Die Probanden wurden angewiesen, zweimal täglich Zahnpasta mit der Bass-Methode bis zu sechs Monaten zu verwenden. Die klinischen Daten wurden zu Studienbeginn, nach drei und sechs Monaten ausgewertet, einschließlich einer Analyse des Plaque-Index, des Gingival-Index und der Blutung bei Sondierung.

Ergebnisse: Über einen Zeitraum von sechs Monaten gab es eine signifikante Reduktion aller klinischen Parameter, die den Gingival-Index, Plaque-Index und Blutung bei Sondierung in der Testgruppe mit t-Test ($P = 0,001$) einschließen. Plantago zeigte eine signifikante Wirkung im Vergleich zur Kontrollgruppe. ANOVA mit wiederholter Messung zeigte ebenfalls einen signifikanten Unterschied ($P = 0,0001$).

Schlussfolgerung: Es zeigte sich in der Untersuchung eine signifikante Reduktion des Plaque-Index, des Gingival-Index und der Blutung während und nach der homöopathischen Behandlung mit Plantago.

以出血和菌斑指數來評估寬葉車前對牙齦炎效用的臨床研究

摘要

背景: 牙齦炎和牙齦菌斑是老年人的一個重要健康問題，佔世界各地超過10%~35%的人口。

目的: 評估牙齦炎患者在使用寬葉車前之前、期間和之後，其牙齦出血量和菌斑指數的變化。

物料和方法: 將30位牙齦炎患者分為兩組：對照組和試驗組。測試者被指引，每日以巴斯刷牙法使用牙膏兩次，持續六個月。然後，在基線、3個月和6個月時進行評估，而該評估包括分析菌斑指數、牙齦指數和出血量。

結果: 經過六個月的時間，以T-檢驗分析，所有臨床參數（包括牙齦指數、菌斑指數和出血量）在試驗組中均顯著下降（ $P=0.001$ ）。與對照組相比，寬葉車前效果更顯著。重複計算方差分析（ANOVA）也顯示出有顯著差異（ $P=0.0001$ ）。

結論: 順勢療法以寬葉車前進行治療前、期間和之後，其菌斑指數、牙齦指數和出血量也顯著下降。