



## Comparative Study of the Effect of *Varnyayoga* Powder and *Varnyayoga* Cream on *Yuvana pidaka* (Acne)

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### Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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### ABSTRACT

**Background:** *Yuvana pidaka* or the *Mukha dhushika* is the disease mentioned in Ayurveda which can be compared with the acne vulgaris in modern medicine. The young age is most vulnerable period for the disease but sometimes it is a problem in other age also. Ayurveda mainly emphasized external treatment for its management but some internal remedies especially *Shodana* treatment are also prescribed.

**Aims:** The aim of this study was to study the effect of *Vaynaya Yoga* powder and Cream on *Yuvana Pidaka*. The target was the overcome the disease as well as the side effects like blackish spots.

**Methodology:** Total 60 diagnosed patients were randomly allocated for three groups and Group I treated with *Varnyayoga* powder and Group II treated with *Varnayayoga* cream and Group III treated with both drugs. Treatment period was two months and assessment was done by the self-prepared grading scale for 12 criteria.

**Results:** The results show that Group III (combine treatment) was the most effective (over all relief was 77.29%) than the other two groups. The Group I and II over all relief was 54.15% and 25.19% respectively.

**Conclusions:** By concluding combine as well as local application is more effective than the internal/oral treatment for *Yuvana Pidaka*.

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**Keywords:** *Yuvana pidaka; acne; management; local application.*

## 1. INTRODUCTION

Healthy and glamorous skin with attractive personality is the natural instinct of mankind. But very few are blessed with naturally perfect skin. People always have great concern about their health and beauty (i.e. good looking). Thus health and beauty are the two faces of a single coin [1].

The face is the feature which distinguishes a person. It is one of the parameter to identify a person. The face is the window of the body and mind, which allows us to communicate with the world around us. The concern of face has taken first place in the present era and all people try to keep their face neat and clean because the face is victim for environment changes as such. The commonest cause for disfigure the face in youths is Acne /*Yuvana Pidaka*.

In Ayurveda, *Acarya Sushruta* was the first and foremost to mention this disease as *Mukhadushika*. The vitiation of Pitta located in the skin i.e. vitiation of *Bhrajaka Pitta* leads the manifestation of *Pidaka* [2]. When this *Pidaka* appears on the face of the young individuals named as *Yuvana Pidaka*. The eruptions are like *Salmali* thorn and caused by *Kapha*, *Vata* and *Shonita* [3].

Acne or *Acne vulgaris* found to have parity with the disease of *Yuvana Pidaka*. It is a chronic inflammatory disease of the pilosebaceous units of the skin with formation of a papules/pustule eruption. It commonly affects the skin of face involving forehead, cheeks, nose and chin. *Acne vulgaris* is a nearly universal skin disease afflicting 79-95% of the adolescent population in westernized societies [4]. Acne affects 80% of individuals between puberty and 30 years of age [5]. It was also recorded in 54% of women and 40% of men over 25 years of age [6]. Other studies have reported acne in 28-61% of school children in the age group 10-12 years; 79-95% in the age group 16-18 years; and even in children in the age group 4-7 years [7,8,9]. In India prevalence data from a dermatology clinic in a teaching hospital in Varanasi reported acne in 50.6% of boys and 38.13% of girls in the age group 12-17 years [10]. Recently it has been found that more patients with acne come to the clinics in their 2nd, 3rd and 4th decade also. This may be due to the irregular & unwholesome diets like junk foods, fast foods, cold drinks, non-veg. diet etc. and irregular routines like work in the

A.C. rooms and changing work shifts. Because of this stress and strain have become an inseparable part of human life. Various psychological factors also have been seen to be a cause for the onset of acne [11]. If the disease left untreated it might be give rise to complications like disfiguring scars, nodules, cysts, keloids and major psychiatric depression and so on.

A lot of remedies are mentioned in Ayurveda classics to cure the disease. There are some remedies which are said not only to cure the disease but also to increase the beauty, complexion and lustre of the face. Different line of treatment prescribed by different *Acaryas* such as Paste (*Lepana*) [12-16], Vomiting (*Vamana*) [12,13,14,16], Bloodletting (*Siravedha*) [13-16], intranasal drug administration (*Nasya*) [14] and oil massage (*Abhyanga*) [15,16].

The treatment for *Yuvana Pidaka*, dozens of external treatment has mentioned in Ayurveda classics [17]. But any drug has not mentioned for internal use other than the *Shodhana* treatments.

The *Varnya Dashshaimani* which has mentioned in *Caraka samhita* [18] is the group of ten drugs which are having *Varnya* property and most of these drugs found in the formulae which has prescribed for the treatment of *Yuvana Pidaka*.

The selected drug formula "*Varnya Yoga*" consists of *Vetiveria zizanioides* (*Uşira*), *Mesua ferrea* (*Nagakeshara*), *Rubia cordifolia* (*Manjistha*), *Glycyrrhiza glabra* (*Yaştimadhu*) and *Hemidesmus indica* (*Sariva*). They are basically *Tridoşashamaka*, *Raktashodhaka*, *Shita virya* and *Kaţu Vipaka*. Many Pharmacological studies have been proved that these herbs have effect on *Propionibacterium acnes*, anti-inflammatory, antimicrobial, antiulcer, antioxidant etc. properties. These ingredients are easily available, easy to administer in patients and cost effective.

Considering these findings the *Varnyayoga* drug was formulated in two dosage forms and effort was made to study the efficacy of *Varnyayoga* powder and the *Varnyayoga* cream in the management of *Yuvana Pidaka*.

## 2. AIMS AND OBJECTIVES

The clinical study was designed on the following aims and objectives:

to evaluate the effect of the *Varnyayoga* Powder on *Yuvana Pidaka*.

to evaluate the effect of the *Varnyayoga* Cream on *Yuvana Pidaka*.

to compare the effect of the *Varnyayoga* Powder over the *Varnyayoga* Cream on *Yuvana Pidaka*.

### 3. MATERIALS AND METHODS

Patients diagnosed as *Yuvana Pidaka* were selected within Age group 12- 34 years, irrespective of sex, religion and socio economic status etc. from the Out Patient Department of the Hospital of National Institute of Ayurveda(NIA), Jaipur, India after acquiring the Informed Consent.

Study period was 10<sup>th</sup> April 2012 to 5<sup>th</sup> June 2013.

The following materials and methods were adopted in the clinical trial.

#### 3.1 Inclusion Criteria

- Age between 12 – 34 years, both male and female
- Patients, complaining of *Pidaka* with the history of less than one year.
- *Pidaka* resembling with the features as explained in classics.

#### 3.2 Exclusion Criteria

- Patients having ulcerated *Pidaka*
- Patients suffering from other types of *Kustha*.
- Patients having allergic history on Herbal drugs.
- Patients suffering from other complicated diseases like Diabetic etc.

#### 3.3 Data Collection

A detailed Proforma was used to collect the necessary data including personal history, past history, family history, signs and symptoms of *Yuvana Pidaka* etc. Interviewer administered data collecting method was used to select the patients and the therapy group was selected by single blind randomized control trial (RCTs) method.

#### 3.4 Selection of the Therapy

The drug formula "*Varnyayoga*" was selected after considering its' Pharmacodynamic

properties to break the pathogenesis of the *Yuvana Pidaka*. Composition of the *Varnyayoga* was as follows.

- *Usira (Vetiveria zizanioides)*
- *Nagakeshara (Mesua ferrea)*
- *Manjistha (Rubia cordifolia)*
- *Madhuka (Glycyrrhiza glabra)*
- *Sariva (Hemidesmus indicus)*

All the raw drugs were identified by the specialists in the P. G. Department of *Dravyaguna Vijnana*, NIA; purchased from local market and processed under good and hygienic manufacturing practice in NIA pharmacy under the supervision of consultant in P. G. Department of *Rasasastra* and *Bhaisjaya kalpana*, NIA.

a) Method of preparation of *Varnyayoga* Powder

All the herbs were taken in equal parts & made them into a fine powder.

b) Procedure of administration of *Varnyayoga* Powder

Dose - 5gm B.D. for 60 days  
*Anupana* - Lukewarm water

c) Method of preparation of *Varnyayoga* Cream

1. 225g of each herb were crushed into coarse powder.
2. The decoction was prepared by adding 10L of water and reduced into ¼.
3. Glycerine, Potassium hydroxide, Borax and preservatives were added to aqueous phase.
4. Bees wax, coco-butter and Stearic acid weighed separately and allowed to melt over steam bath.
5. Solution was prepared in step 3 slowly added to wax base prepared in step 4 while stirring till cream was prepared.

d) Procedure of administration of *Varnyayoga* Cream

The affected area was cleaned properly with clean water before applying the cream. After that sufficient amount of cream applied over the area and keep for one to two hours and washed out with water. This procedure was followed morning and evening for 60 days.

#### 3.5 Drug Schedule for the Patients

Group I – 20 patients were treated with *Varnyayoga* Powder 5g, two times a

- day, before meals orally with Luke warm water for two months.
- Group II – 20 patients were treated with *Varnyayoga* Cream applied (as sufficient amount) over the affected area after cleaning with water for twice a day for two months.
- Group III – 20 patients were treated by both, *Varnyayoga* Powder (Internally) and *Varnyayoga* Cream (Externally) as mentioned in groups I and II, for two months.

### 3.6 Criteria for the Final Assessment

Effect of the therapies was compared before and after treatment on the basis of scoring scale for following signs and symptoms.

#### a. Parameters

- a. Location of *Piḍaka*
- b. Number of *Piḍaka*
- c. Type of *Piḍaka*
- d. Associate with Pain
- e. Presence of Discharge
- f. Presence of itching
- g. Oily face
- h. Black scars
- i. Severity of Comedones
- j. Severity of Papules
- k. Severity of Pustules
- l. GAGS criteria

#### b. Assessment of the symptoms

Self-developed grading system was prepared for the above mentioned symptoms and they were assessed before and after treatment. (Table 1)

#### c. Gradation Index for Overall Response

The overall results were assessed based on data obtained before and after treatment. The percentage of improvement was calculated and graded in following ways.

- Excellent response relief - 80% - 100%
- Good response relief - 79% - 60%
- Moderate response relief - 59% - 40%
- Mild response relief - 39% - 20%
- Unchanged relief - less than 20%

#### d. Statistical Analysis of the Results

The effect of therapies on selected subjective parameters has been assessed by giving a specific gradation to these symptoms which has been described earlier. The results were assessed by applying Wilcoxon matched - pairs Signed-ranks Test.

## 4. RESULTS AND DISCUSSION

The present study was conducted to evaluate the efficacy of *Varnyayoga* on *Yuvana Pidaka*. The 60 patients suffering from *Yuvana Pidaka*, fulfilling the inclusion criteria were randomly registered in three groups. All the patients were received the trial drug as per the research protocol. Among them maximum 68.33%) were belongs to 18 – 23 age group and maximum were female. Most of them were (85%) were students in U.G. level.

The directly associated features like having family history, taking oily, spicy and fast food, association of menstruation in female persons were dominant. Most of them were didn't have any treatment and pain and swelling were the dominant *Purva Rupa*. Presence of the permanent scar was more dominant.

### 4.1 Effect of Therapies

The effect of therapies on subjective parameters has been assessed by giving a specific gradation to these symptoms which has been described earlier. The results were assessed by applying Wilcoxon matched - pairs Signed-ranks Test.

The statistical values are shown in the following tables and following abbreviation are being used:

- ES = Extremely Significant
- VS = Very Significant
- S = Significant
- NS = Not Significant

### 4.2 The Effect of Therapy on Subjective Parameters in Group I

The effect of the *Varnayayoga* powder on each parameter is shown in the Table No. 02.

Above data shows that changes of the Comedones, Papules and GAGS criteria were Excellent significant, changes of the Pustules was very significant, other changes were significant and change of the Itching was not significant.

**Table 1. Grading and scoring system for each assessment criteria**

Criteria	Grading	Score
1. Location of <i>Pidaka</i>	No <i>Pidaka</i>	0
	1 or 2 areas	1
	3 or 4 areas	2
	5 or 6 areas	3
2. Number of <i>Pidaka</i>	No <i>Pidaka</i>	0
	1 - 5	1
	5 - 10	2
	More than 10	3
3. Type of <i>Pidaka</i>	No <i>Pidaka</i>	0
	Comedones only	1
	Comedones + Papules	2
	Comedones + Papules + Pustules	3
4. Associate with Pain	No Pain	0
	Pain on deep pressure	1
	Pain on mild pressure	2
	Continuous Pain without touching	3
5. Presence of Discharge	No discharge	0
	Clear discharge	1
	Whitish discharge	2
	Reddish discharge	3
6. Presence of itching	No itching	0
	Itching on and off	1
	Always itching in some <i>Pidaka</i>	2
	Always itching in all <i>Pidaka</i>	3
7. Oily face	No oily face	0
	Face become oily 3 – 4 hours after face wash	1
	Face become oily 1 - 2 hours after face wash	2
	Require face wash frequently	3
8. Acne scars (Black scars)	No acne scars	0
	1- 5 scars	1
	6-10 scars	2
	More than 10 scars	3
9. Severity of Comedones	0.5 x number of Comedones	Value
10. Severity of Papules	1 x number of Papules	Value
11. Severity of Pustules	2 x number of Pustules	value
12. GAGS criteria	Area factor x most severe lesion factor (in six areas)	Sum of all

#### 4.3 The Effect of Therapy on Subjective Parameters in Group II

The effect of the *Varnayayoga* cream on each parameter is shown in the Table 3.

The data shows that changes of the location of *Pidaka*, Number of *Pidaka*, type of *Pidaka*, Oily face, Black scars, Comedones, Papules, Pustules and GAGS criteria were extremely significant. Change of the pain was very significant and for the discharge it was

significant. But change of the itching was not significant.

#### 4.4 The Effect of Therapy on Subjective Parameters in Group III

The effect of the *Varnayayoga* powder and cream on each parameter is shown in the Table No. 04.

The above data shows that changes of the all parameters were extremely significant except itching. For itching it was very significant.

**Table 2. Changes of the Subjective parameters in Group I**

Subjective Parameter	Mean Score			% of Change	SD ±	SE ±	p value	Result
	BT	AT	Diff.					
Location of <i>Pidaka</i>	2.7	2.350	0.35	12.96	0.4894	0.1094	0.0156	S
Number of <i>Pidaka</i>	2.95	2.65	0.3	10.17	0.4702	0.1051	0.0313	S
Type of <i>Pidaka</i>	2.5	2.2	0.3	12	0.4702	0.1051	0.0313	S
Pain	1.65	1.3	0.35	21.21	0.5871	0.1313	0.0313	S
Discharge	1.55	1.25	0.3	19.36	0.4702	0.1051	0.0313	S
Itching	0.6	0.25	0.35	58.33	0.8127	0.1817	0.1250	NS
Oily face	2.6	2.3	0.3	11.54	0.4702	0.1051	0.0313	S
Black scars	2.55	2.25	0.3	11.77	0.4702	0.1051	0.0313	S
Comedones	14.6	8.7	5.9	40.41	5.230	1.170	<0.0001	ES
Papules	7.65	4.8	2.85	37.26	2.412	0.5394	<0.0001	ES
Pustules	3.4	1.7	1.7	50.00	2.452	0.5482	0.0078	VS
GAGS criteria	11.6	9.6	2.0	17.24	1.124	0.2513	<0.0001	ES

**Table 3. Changes of the Subjective parameters in Group II**

Subjective Parameter	Mean Score			% of Change	SD ±	SE ±	p value	Result
	BT	AT	Diff.					
Location of <i>Pidaka</i>	2.45	1.6	0.85	34.69	0.8127	0.1817	0.0005	ES
Number of <i>Pidaka</i>	2.9	1.5	1.4	48.28	0.7539	0.1686	<0.0001	ES
Type of <i>Pidaka</i>	2.55	1.5	1.05	41.18	0.8256	0.1846	<0.0001	ES
Pain	1.3	0.45	0.85	65.39	0.9881	0.2209	0.0039	VS
Discharge	0.75	0.25	0.5	66.67	0.8885	0.1987	0.0313	S
Itching	0.4	0.15	0.25	62.50	0.5501	0.1230	0.1250	NS
Oily face	2.1	1.45	0.65	30.96	0.7452	0.1666	0.0010	ES
Black scars	2.2	1.55	0.65	29.55	0.5871	0.1313	0.0005	ES
Comedones	13.4	3.5	9.9	73.88	5.067	1.133	<0.0001	ES
Papules	5.3	1.3	4.0	75.47	3.026	0.6767	<0.0001	ES
Pustules	2.1	0.4	1.7	80.95	1.625	0.3635	<0.0005	ES
GAGS criteria	9.8	5.85	3.95	40.31	3.252	0.7272	<0.0001	ES

**Table 4. Changes of the Subjective parameters in Group III**

Subjective Parameter	Mean Score			% of Change	SD ±	SE ±	p value	Result
	BT	AT	Diff.					
Location of <i>Pidaka</i>	2.75	1.1	1.65	60	0.5871	0.1313	<0.0001	ES
Number of <i>Pidaka</i>	2.95	0.9	2.05	69.49	0.3940	0.08811	<0.0001	ES
Type of <i>Pidaka</i>	2.8	1.15	1.65	58.93	0.5871	0.1313	<0.0001	ES
Pain	1.9	0.05	1.85	97.37	1.226	0.2741	<0.0001	ES
Discharge	1.35	0.15	1.2	88.89	1.056	0.2362	0.0002	ES
Itching	1.05	0.1	0.95	90.48	1.099	0.2458	0.0039	VS
Oily face	2.35	0.3	2.05	87.23	0.9445	0.2112	<0.0001	ES
Black scars	2.45	1.4	1.05	42.59	0.6048	0.1352	<0.0001	ES
Comedones	14.15	3.4	10.75	75.97	4.811	1.076	<0.0001	ES
Papules	7.1	0.55	6.55	92.25	3.576	0.7996	<0.0001	ES
Pustules	4.65	0.4	4.25	91.40	4.423	0.9891	<0.0001	ES
GAGS criteria	14.15	3.85	10.3	72.79	4.414	0.9870	<0.0001	ES

**Table 5. Over all response of three groups**

Parameter	% of Relief in Group I	% of Relief in Group II	% of Relief in Group III
Location of <i>Pidaka</i>	12.96	34.69	60.00
Number of <i>Pidaka</i>	10.17	48.28	69.49
Type of <i>Pidaka</i>	12.00	41.18	58.93
Association with pain	21.21	65.39	97.37
Presence of Discharge	19.36	66.67	88.89
Presence of Itching	58.33	62.50	90.48
Oily face	11.54	30.95	87.23
Black scars	11.77	29.55	42.59
Severity of Comedones	40.41	73.88	75.97
Severity of Papules	37.26	75.47	92.25
Severity of Pustules	50.00	80.95	91.40
GAGS criteria	17.24	40.31	72.79
Average %	<b>25.19</b>	<b>54.15</b>	<b>77.29</b>

**Table 6. Effect of therapy on each group as mentioned in the methodology**

Response	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
Excellent	00	00	00	00	08	40
Good	01	05	10	50	11	55
Moderate	01	05	08	40	01	05
Mild	15	75	02	10	00	00
Unchanged	03	15	00	00	00	00

#### 4.5 Over All Response

The percentage of relief of subjective parameters (overall response) of each group is shown in the Table 5.

#### 4.6 Overall Effect of Therapy

In group I, the maximum patients i.e. 15 (75%) were shown mild response. In group II, the maximum patients i.e. 10 (50%) were shown good response. In group III, the maximum patients i.e. 11 (55%) were shown good response and 8 patients (40%) were shown excellent response.

The signs and symptoms produced in particular disease and the line of treatment laid down is to be considered for the selection of the drug or drug combination. This approach has been accepted for this study. The main clinical features of *Yuvana Pidaka* are appearance of *Ghana Pidaka* (hard Papules) with painful and most of them end up with temporary or permanent black spots/scars which lead to the discoloration of the face. Though there is no specific line of treatment for *Yuvana Pidaka* has mentioned in Ayurveda texts, one can prescribe the drugs by considering the *Doshic* involvement.

In *Yuvana Pidaka*, *Kapha* and *Vata* are the main *Dosha*; *Rakta* is the main *Dushya* and *Vaivarnyata/Mukhadushana* is the main complication. Considering these facts the Drug "*Varnya Yoga*", five drugs out of ten drugs mentioned in *Varnya Dashaimanī* has been selected having following aims:

1. To combat on the involved *Dosha*
2. To combat on the involved *Dushya*
3. To relief/minimize the signs and symptoms of the disease.
4. To minimize the complication like *Vaivarnyata / Mukhadushana*

Keeping the target on those aims, the selected Drug "*Varnya Yoga*" should have the following activities.

1. *Vatakaphahara*
2. *Raktashodhaka*
3. *Shothaghna, Kandughna, Medoghna, Vishaghna* etc.
4. *Varnyakara*

The "*Varnya Yoga*" drug consists of *Ushira, Nagakeshara, Manjistha, Yashthimadhu* and *Sariva*.

Many scientific research works conducted on these herbs. Act against the acne as well as on

other relative activities like anti-inflammatory, antimicrobial, anti-ulcer, antioxidant etc. properties were identified as a single herb as well as compound preparations including other herbs. Some of them are experimental works and some are clinical research.

*Glycyrrhiza glabra* showed a remarkable antibacterial activity against *P. acnes* [19]. The methanol extracts of *C. sinensis*, *G. glabra* and *C. officinalis* can be a good source of natural antioxidants to prevent free radical mediated oxidative stress in acne [20]. In another study the extracts showed significant antibacterial activities against two gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*) and two gram-negative (*Escherichia coli* and *Pseudomonas aeruginosa*) bacteria [21]. A compound preparation of root extracts of *R. cordifolia* and *G. glabra* exhibited the antimicrobial activity [22] Another study *G. glabra* extract showed antibacterial activity against six bacteria [23]. *Ushira* (*Vetiveria zizanioides* (Linn.) ) was used in lotions, compresses and baths for the treatment of oily skin, acne and weeping sores [24]. Antimicrobial activity of *V. zizanioides* was more likely a result of the additive or synergistic effect of several compounds [25]. The Anti-inflammatory activity of methanol extract of *Vetiveria zizanioides* root was studied and showed decreased formation of granuloma [26]. Compound preparation of *Rubia cordifolia*, *Curcuma longa*, *Hemidesmus indicus* and *Azadirachta indica* shows anti-inflammatory activity by suppressing the capacity of *P. acnes*[27]. The methanol extract of *Hemidesmus indicus* can be a potential source of a natural cytotoxic, antioxidant and good antimicrobial agent [28]. The anti-inflammatory effect of ethanolic extract of *Hemidesmus indicus* support the traditional use of this plant in inflammatory conditions [29]. Anti-acne activity containing an antimicrobial lipophilic extract of *Mesua ferrea* showed good result [30]. Antimicrobial activity - The methanol extract from the leaves [31] and whole flower [32] of *Mesua ferrea* Linn. showed the highest antibacterial activity. *R. cordifolia* inhibits the proliferation of *Propionibacterium acnes* and hence prevents its consequences [33]. A gel formulation containing 0.1% of anthraquinone rich fraction exhibited optimum anti-acne activity against *P. acnes*, *S. epidermidis*, *M. furfur* [34]. A clinical trial has shown the statistically significant results in acne [35]. *Rubia cordifolia* (*Manjishtha*): is well known for its anti-pyrogenic properties [36]. Ethanolic extract of Stem of *Rubia cordifolia* Linn and roots shows good anti-inflammatory activity [37,38]. *Rubia*

*cordifolia*, Linn. showed significant anti-inflammatory activity at a dose of 10 and 20 ml/kg of the water extracts [39]. Other compound preparations [40,41] which including above drug had been proved the effect on Acne. Based on these findings, the effect of this particular combine therapy (*Varnayayoga* powder and cream) can be confirmed its efficacy in the treatment of *Yuvana Pidaka* apart from improving the complexion of the skin.

## 5. CONCLUSION

*Yuvana pidaka* or the acne vulgaris is the disease especially due to the *Propionibacterium acnes* bacteria. As it is localized infection, the local treatment is enough for the management of the disease. But while giving internal medicine along with the local treatment the effect is much better than the local treatment. Further while using the drugs which promote the skin complexion they alleviate the complications of the disease like scars and blackish discoloration also.

## CONSENT AND ETHICAL APPROVAL

Ethical clearance was obtained from the Institutional Ethics Committee dated on 29/3/2012 and No. F10 (5)/EC/2012/298. Ethical approval by the ERC and informed consent from the patient was taken before the treatment.

## DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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