Comparative Evaluation of Diode Laser with & with -out Sodium Fluoride Varnish in the Treatment of Dentin Hypersensitivity - A Clinical & Scanning Electron Microscopy Study

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Abstract :

Background: The aim of the present study was to evaluate clinically and under scanning electron microscopy (SEM) the efficacy of DIODE laser irradiation alone and in combination with 5% sodium fluoride varnish in the management of dentin hypersensitivity.

Methods: The study was conducted on 60 patients divided into four groups who had at least one tooth of Grade III mobility with clinically elicitable dentin hypersensitivity. Following the pretreatment assessment of hypersensitivity using the visual analog scale (VAS) and cold air blast test, the selected tooth in all the groups received 1% citric acid treatment for 1 minute. Group 1 patients received no further treatment; group 2, 3, and 4 patients received additional treatment with 5% sodium fluoride varnish, DIODE laser for 1 minute, and a combination of 5% sodium fluoride varnish and DIODE laser, respectively. Two hours following treatment, hypersensitivity was again assessed, and the teeth were extracted, sectioned, and scanned using scanning electron microscopy (SEM).

Results: VAS scale values showed that the score increased in group 1 from baseline to 2 hrs by 2.06±0.25whereas in other groups the value significantly decreased. The decrease in values for group 2 was 1.93±0.45, for group 3 was 1.80±0.56 and for group 4 was 2.40±0.50. Hence group 4 proved to be best in reducing the vas scale score. Air blast scale values showed that the score increased in group 1 from baseline to 2 hrs by 1.00±0.00 whereas in other groups the value significantly decreased. The decrease in values for group 2 was 1.06±0.25 , for group 3 was 1.20±0.41 and for group 4 was 1.46±0.63. Hence group 4 proved to be best in reducing the air blast scale score. The number of patent tubules also progressively decreased from group 1 through group 4.

Conclusions: The combination of DIODE laser and 5% sodium fluoride varnish seems to show an impressive efficacy, when compared to either treatment alone, in treating dentin hypersensitivity. The SEM findings seem to relate to the clinical findings in that reduction in number/patency of tubules was associated with improvement in treatment efficacy.

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Introduction

Dentin is the main supporting structure of the tooth and consists of an organic component containing collagen fibers in a matrix of collagenous proteins and an inorganic component containing hydroxyapatite crystals. Within dentin, dentinal tubules are present, which extend from the external surface to the pulp[1] . Dentin hypersensitivity has been defined as a "short, sharp pain arising from exposed dentin in response to stimuli typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other form of dental defect or pathology."[4]

The etiology of dentin hypersensitivity is multi-factorial. Dentin exposure may be the result of abfraction, abrasion, erosion and denudation of the root surface. Most common etiologic factor is gingival recession exposing the root surface due to gingival diseases, aging, incorrect tooth brushing, periodontal treatment, surgical /dental operative procedures and association of two or more of these factors.[8] dentin hypersensitivity can be treated by different ways; first by reducing the dentinal tubules hypoconduction by occluding them; second, by reducing the nerve fibers excitability and/ or by a combination of these two approaches.[15]

Materials & Methodology

The present study was conducted in 2 parts : in-vitro and in –vivo .for in –vivo part 60 patients will be selected from out patient department, d.j college of dental sciences and research, modinagar. For in- vitro part ,2 hours post treatment., the teeth were extracted and prior to sectioning, the teeth will be stored in distilled water with thymol as preservative.

Criteria for Tooth Selection

Inclusion criteria

1. Male and female in the age range of 25 to 55 years
2. Patients in good systemic health
3. All experimental teeth had Grade III Mobility.

Exclusion criteria

1. Carious teeth
2. Restored teeth
3. Fractured teeth
4. Rct treated teeth
5. Teeth with developmental anomalies.
6. Teeth that demonstrated the presence of any wasting diseases.

All patients will have to undergo scaling and polishing before the study and will be instructed not to use any other desensitizing agent during the study.

Patients Randomly Divided Into 4 Groups:

- In group 1 the selected tooth in each patient will be isolated with a cotton roll and 1% citric acid would be applied by means of a cotton swab for 1 min.
- In group 2 the selected tooth in each patient, first treated with 1% citric acid as in group 1 and the excess moisture will be removed from the area being treated. The area will be isolated, and a thin film of 5% sodium fluoride varnish would be painted on the sensitive surface with a disposable micro brush.
- In group 3 selected tooth first treated with 1% citric acid as in group 1 and the sensitive surface was lased with diode laser by light painting for 1 min the beam directed parallel to the dentinal tubules and perpendicular to the dentinal surface.
- In group 4 following citric acid treatment as in group 1, the selected tooth in each patient was treated with 5% naf varnish as in group 2, followed by diode laser as in group 3.

The post treatment hypersensitivity was assessed subjectively using the visual analog scale and cold air blast after 2 hours.

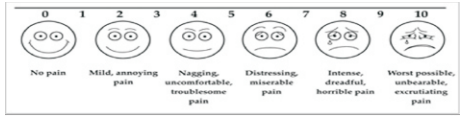
Following clinical parameters were recorded at the baseline, and after 2 hours.

VAS: the subjects placed a mark on a 10cm long line on the vas that is labelled from "no pain" (0) to "intolerable pain" (10).

*The scoring criteria for the vas scale was as follows:

0	No Pain
1-3	Light Pain
4-6	Moderate Pain
7-9	Strong Bearable Pain
10	Intolerable Pain

VAS SCALE:



To record subject's response to stimuli, teeth were isolated with cotton rolls and wiped with a cotton pellet to remove any debris. At each evaluation, subjects were recorded on the VAS scale.

Comparison of Percentage Occlusion of Tubules Among 4 Groups

	Mean	Std. Deviation	Std. Error	F Value	P Value
Group 1	36.26	5.59	1.445	326.922	0.001
Group 2	76.80	7.38	1.907		
Group 3	84.93	3.89	1.006		
Group 4	89.86	2.85	0.735		

Table-1 showed comparison of percentage occlusion of tubules among 4 groups .

The percentage occlusion of tubules for showed significant difference among the groups, in which Group 1 showed the least percentage occlusion of tubules (36.26). Group 3 (84.93) showed better than group 2 (76.80). The percentage occlusion of tubules was greatest for Group 4 (89.86) . Hence Group 4 was the best in occluding dentinal tubule.

Post HOC LSD Analysis –Intergroup Comparison:

GP	GP	Mean Difference	Std. Error	Sig.	Significance
Group I	Group 2	40.53333*	1.90863	.000	Significant
	Group 3	48.66667*	1.90863	.000	Significant
	Group 4	53.60000*	1.90863	.000	Significant
Group II	Group 1	40.53333*	1.90863	.000	Significant
	Group 3	8.13333*	1.90863	.000	Significant
	Group 4	13.06667*	1.90863	.000	Significant
Group III	Group 1	48.66667*	1.90863	.000	Significant
	Group 2	8.13333*	1.90863	.000	Significant
	Group 4	4.93333*	1.90863	.012	Significant
Group IV	Group 1	53.60000*	1.90863	.000	Significant
	Group 2	13.06667*	1.90863	.000	Significant
	Group 3	4.93333*	1.90863	.012	Significant

AIRBLAST SCALE

Group	Baseline	2 hrs.	Mean	Percent	F Value	P Value
Group I	1.13±0.74	2.13±0.74	1.00±0.00	79.16±25.74	7.316	0.001
Group II	2.00±0.84	0.93±0.79	-1.06±0.25	-63.33±28.31		
Group III	2.20±2.20	1.00±0.65	-1.20±0.41	-60.00±23.40		
Group IV	2.33±2.33	0.86±0.74	-1.46±0.63	-66.66±26.72		

Air blast scale values in table 3 showed that the score increased in group 1 from baseline to 2 hrs by 1.00±0.00 whereas in other groups the value significantly decreased. The decrease in values for group 2 was 1.06±0.25 , for group 3 was 1.20±0.41 and for group 4 was 1.46±0.63. Hence group 4 proved to be best in reducing the air blast scale score.

VAS\SCALE

Group	Baseline	2 hrs.	Mean Change	Percent Change	F Value	P Value
Group I	4.20±1.47	6.26±1.43	2.06±0.25	56.57±24.96	113.699	0.001
Group II	5.60±1.88	3.66±1.73	-1.93±0.45	-37.91±15.06		
Group III	5.13±1.80	3.33±1.63	-1.80±0.56	-37.84±13.12		
Group IV	6.20±1.74	3.80±1.65	-2.40±0.50	-41.19±13.55		

Vas scale values in table 5 showed that the score increased in group 1 from baseline to 2 hrs by 2.06±0.25whereas in other groups the value significantly decreased. The decrease in values for group 2 was 1.93±0.45, for group 3 was 1.80±0.56 and for group 4 was 2.40±0.50. Hence group 4 proved to be best in reducing the vas scale score.

Discussion

Dentine hypersensitivity (DH) is a painful response of the tooth to different stimuli such as brushing, low pH beverages, occlusal overload, dental caries and thermal changes[47]. DH is characterized by a rapid onset of sharp burst of pain, lasting for seconds or minutes. The desired goal for treatment of dentin hypersensitivity is attainment of immediate as well as lasting relief from discomfort. This is achieved by application of a desensitizing agent used alone or as an adjunct to another dental procedure. Till date no such treatment has been discovered and there is no 'gold standard' by which one can assess the efficacy of the agent used[48].

The Scanning Electron Microscopic analysis was done and the results were as follows:

Table-1 showed comparison of percentage occlusion of tubules among 4 groups .The percentage occlusion of tubules showed significant difference among the groups, in which group 1(citric acid) showed the least percentage occlusion of tubules (36.26). (diode laser) Group 3 (84.93) showed better than (5% sodium fluoride varnish) Group 2 (76.80). The percentage occlusion of tubules was greatest for (5% sodium fluoride varnish + diode laser) Group 4 (89.86) . Hence Group 4 was the best in occluding dentinal tubules.

Air blast scale values in table 3 showed that the score increased in group 1 (citric acid) from baseline to 2 hrs by 1.00±0.00 whereas in other groups the value significantly decreased. The decrease in values for (5% sodium fluoride varnish) group 2 was 1.06±0.25 , for (diode laser) group 3 was 1.20±0.41 and for (5% sodium fluoride varnish + diode laser) group 4 was 1.46±0.63. Hence group 4 proved to be best in reducing the air blast scale score.

Vas scale values in table 5 showed that the score increased in group 1(citric acid) from baseline to 2 hrs by 2.06±0.25whereas in other groups the value significantly decreased. The decrease in values for (5% sodium fluoride varnish) group 2 was 1.93±0.45, for (diode laser) group 3 was 1.80±0.56 and for (5% sodium fluoride varnish + diode laser) group 4 was 2.40±0.50. Hence group 4 proved to be best in reducing the vas scale score.

Till date no studies have been performed on the evaluation of laser in combination with 5% sodium fluoride varnish for the treatment of dentin hypersensitivity. The present study shows that there is statistically significant reduction in VAS scores from baseline to 2 hrs and in cold air blast test. Thus, laser in combination with 5% sodium fluoride varnish may be considered advantageous in reducing the dentin hypersensitivity

In the present study, laser also showed statistically significant reduction in the Dentinal Hypersensitivity when used alone. This was in accordance with the study of Gerschman et al (1994)[62] investigated the effect of Low level laser therapy for dentinal tooth hypersensitivity using low level laser gallium- aluminium –arsenide laser [GaAlAs] against placebo and found significant reduction in the laser-treated group. In fact, sensitivity to thermal stimuli was reduced by 67%, whereas the placebo group had a reduction of 17%, sensitivity to tactile stimuli was reduced by 65%, while the placebo group showed a reduction of 21%. They concluded that low level laser gallium-aluminium –arsenide laser [GaAlAs] is an effective method for the treatment of both thermal and tactile hypersensitivity.

A study carried out by Brugnera et al (1989)[60] on treatment of dentinal hypersensitivity with diode laser showed the immediate analgesic effect using a diode laser.

In contrary, a study by Lier et al (2002)[29] on the treatment of dentin hypersensitivity by Nd:YAG laser showed that patients treated with laser did not show any difference than those treated with placebo.

On the other hand, a study by Corona et al (2003)[31] on the clinical evaluation of low-level laser therapy and fluoride varnish for treating cervical dentinal hypersensitivity showed that both lasers and sodium fluoride varnish are equally effective in providing relief to patients suffering from cervical dentinal hypersensitivity.

In the present study, 5% sodium fluoride varnish also showed statistically significant reduction in the DH when used alone. This was in accordance with the study by Olga D. Flecha et al (2013)[43] on 5% sodium fluoride varnish Versus Laser in the Treatment of Dentin Hypersensitivity in which they concluded that 5% sodium fluoride varnish is as effective as low-intensity laser in reducing Dentinal hypersensitivity. In addition, it is a more accessible and low-cost procedure and can be safely used in the treatment of Dentinal hypersensitivity.

Intragroup comparison shows that there is statistically significant reduction in Dentinal hypersensitivity from baseline to 2 hrs with respect to cold air blast test in groups 2, 3 and 4.

Conclusion

Laser showed statistically significant reduction in the Dentinal Hypersensitivity when used alone and 5% sodium fluoride varnish showed statistically significant reduction in the DH when used alone. laser in combination with 5% sodium fluoride varnish may be considered most advantageous in reducing the dentin hypersensitivity.

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More References are available on request at editor@healtalkht.com