Immediate Efficacy of Diode Laser Application In The Treatment of Dentine Hypersensitivity In Periodontal Maintenance Patients: A Randomized Triple- Blinded Placebo Controlled Clinical Trial

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Abstract:

Dentine hypersensitivity (DH) is a painful response of the tooth to different stimuli.

Aims: To evaluate the immediate efficacy in the reduction of dentine hypersensitivity (DH) when applying 810nm diode laser (DL), and commercial toothpaste containing Arginine bicarbonate.

Methods and Material: Sixty periodontal maintenance patients of both sexes, with a DH≥2 on the verbal rating scale (VRS) in one or more teeth, were randomly allocated into three equal groups: 20 patients received DL and placebo gel (group A); 20 patients were tested with placebo laser and a commercial toothpaste containing arginine bicarbonate (group B) and the remaining 20 received a placebo laser and placebo gel (group C). The DH was evaluated at the start of the study, 15 and 30 minutes after the laser application, and on days 2 and 7 by a blind examiner.

Statistical analysis used: Mann Whitney U Static; Kruskal- Wallis statistic

Results: Group A shows greater effectiveness in reducing dentine hypersensitivity.

Conclusions: There is definite clinical improvement in DH patients when diode laser is used, with slight clinical advantage over arginine bicarbonate.

Key-words: Dentine hypersensitivity, diode laser, periodontal patients, Arginine bicarbonate.

Key message: DH can be treated effectively by a one-time application of diode laser.

Introduction:

Dentine hypersensitivity(DH) is a painful response of the tooth to different stimuli[1].

The most accepted theory for explaining DH is "the hydrodynamic theory"[2].Various clinical studies have shown the efficacy of arginine bicarbonate, as a desensitizing agent[3,4,5]; promoting precipitation of calcium rich mineral layer, as well as irradiation of affected teeth with different types of laser[6,7], as treatment options for dentine hypersensitivity.

The present placebo controlled study was designed to compare the immediate effectiveness of a 60 second application of 810 nm diode laser with that of arginine bicarbonate application for treatment of dentine hypersensitivity.

Subjects & Methods:

Sixty patients (20 to 70 years of age) with DH ≥ 2 on verbal rating scale (VRS) were selected from the-Buddha Institute of Dental Sciences and Hospital, Patna. Those patients who were not having any systemic disease, any restorations or cavities and patients with no allergy to any medication and patients who have not used dentine hypersensitivity treatment in the previous 30 days were included in the study. All these patients had reported for review and maintenance and had PI<1 and had not undergone SRP in last 30 days.

For each patient, an envelope (Envelop A) was created, which contained the patient's initials and contained information regarding the laser treatment to be applied (active or inactive) and a tube with no description of its content (arginine bicarbonate or placebo). A second set of envelops (Envelop B) contained full information about the treatment to be provided (laser and gel). This was opened only after the completion of the study.

A three-member team conducted the study. The examiner (1st member), was in charge of carrying out the initial assessment and the monitoring of patients, as well of teaching the way the gel should be applied (arginine bicarbonate or placebo) and the oral hygiene techniques. The examiner was not aware of the type of treatment applied. A second member of the team, with no information on the patients' or study's characteristics, was in charge of opening envelop A containing the type of laser treatment (either laser or placebo) to be used and of applying the said treatment. Finally, the third member was in charge of the custody of envelopes B with detailed information about the treatment that was applied. At the end of the study, those envelopes were opened to build the study's data matrix.

DH was evaluated at the start of the study, 15 and 30 minutes after the laser application, and on days 2, 7, and 60 by a blind examiner. Once accepted into the study, the first member gave brushing instructions to the patients and prohibited them from using any fluoride toothpaste or mouthwash during the period of study.

The second member gave laser or placebo laser treatment to the patient. The test group was treated using a diode laser with a wavelength of 810 nm at an output of 0.7mW, for 1 minute. The placebo laser group was treated using an inactive laser point.

Relevant records were taken (ES, TS, and GSE) 15 minutes, 30 minutes after the study and on days 2, 7 and 60 by the third member.

The results were analyzed statistically at The Indian Statistical Institute, Kolkatta.

Clinical measures:

The clinical efficacy of the treatment was evaluated using the following procedures:

1.) ES (Evaporative stimuli) was used as the main variable for the study. The selected tooth was isolated, dried and a jet of air was applied using a dental syringe from a distance of 1 cm for 1second (Tarbet et al 1979, Collins et al 1984)[8,9]. Patient responses were recorded according to the VRS scale:

0: No discomfort, but patient felt stimulus.
1: Slight discomfort, but not painful.
2: Painful during application of stimulus.
3: Painful during application of stimulus and immediately afterwards.

2.) To evaluate TS (Tactile Stimuli) the stimulus was applied by scraping the exposed radicular surface of the tooth by means of periodontal probing (Collins et al. 1984, Silverman 1986)[9,10]. The patient's response

was classified according to the aforementioned VRS scale.

3.) GSE (Global Subjective Stimuli) (Tarbet et al 1980,Silverman 1986, Clark et al 1987,Minkoff & Axelrod 1987)[11] was evaluated by recording the patient's level of sensitivity to common stimuli experienced in his or her daily life. The patient recorded his or her sensitivity level on a scale of 0–5 points, 0 for no sensitivity and 5 for maximum sensitivity.

Results:

According to statistical analysis:

1. Group A shows greater effectiveness in reducing DH.
2. There is always a reduction in outcome measures over time in all the groups studied.
3. The higher p values indicate strong evidence in favor of the null hypothesis (i.e. equality in treatment effectiveness).

No side effects, adverse reactions, pulp damage, or any other clinically detectable complications were observed at the energy and power settings used.

Discussion:

Our study shows a clinically important reduction of DH using the DL after the stipulated time intervals. The positive control of the arginine containing toothpaste compared well with the diode laser.

We have also seen a high efficacy of the placebo laser, which is backed up by previous studies evaluating the role of placebo laser in clinical DH tests[12,13,14,15].

Based on our study it can be concluded that there is a definite clinical improvement in DH patients when diode laser is used. This mode of DH treatment has slight clinical advantage over arginine based toothpaste and placebo laser treatment. Application of lasers under controlled parameters for this indication does not lead to adverse effects. More large sample-sized, long-term, high quality root canal treatments (RCTs) are needed before definitive conclusions can be made.

Future Studies:

More large sample-sized, long-term, high quality RCTs involving DL, DL + arginine, DL + topical desensitizing agents with/without placebo controls are required.

References:

References are available on request at editor@healtalkht.com

Table 1: Reduction in dentine hypersensitivity response to evaporative stimulus (ES) in the group treated with Group A and in control groups (Group B & Group C)

Treatment	15 Min Mean(SD)	30 Min Mean(SD)	Reduction(15-30) Mean(SD)	2 Day Mean(SD)	Reduction(30 Min-2 Day) Mean(SD)
Group A(n=20)	1.25(.967)	.70(.92)	.55(.60) 44%	.95(.68)	-.25(.55) -36%
Group B+Group	1.35(.622)	1.225(.698)	.4(.68) 9.25%	1.0(.59)	.225(.66)
	t=-.42 P=.685	t=-2.46 P=.992	U=731.00 P=.0367	t= -0.29 p = 0.614	U=467.5 P=.007

U=Observed value of Mann Whitney U statistic; t=observed value of two sample t test; P=p value

Table 2: Reduction in dentine hypersensitivity response to tactile stimulation (TS) in the group treated with Group A and in control groups (Group B & Group C)

Treatment	15 Min Mean(SD)	30 Min Mean(SD)	Reduction (15-30) Mean(SD)	2 Day Mean(SD)	Reduction (30 Min-2 Day)
Group A(n=10)	1.05(.88)	.75(.91)	.3(.67)	0.65(.58)	.45(.64)
Group B+Group	1.35(.70)	.975(.66)	.55(.88)	0.77(.69)	.25(.56)
	t=-1.43 P= 0.921	t = -1.09 P = 0.861	U=593.5 P= 0.7805	t = -0.69 P= 0.753	U=569 P= 0.5254

U=Observed value of Mann Whitney U statistic; t=observed value of two sample t test; P=p value

Table 3: Reduction in dentine hypersensitivity response to evaporative stimulus (ES) in the three treatment groups from 15 min. to day 7 (end of the study)

Treatment	15 Min Mean(SD)	30 Min Mean(SD)	2 Day Mean(SD)	7 Day Mean(SD)	Reduction (15Min- 2 day) Mean(SD)	Reduction (2 day-7 day) Mean(SD)	Reduction (15min-7day) Mean(SD)
Group A (n=10)	1.25(.96)	.7(.92)	.95(.68)	.85(.75)	.30(.73) 24%	.10(.31) 10%	.40(.68) 46%
Group B (n=10)	1.33(.64)	1.0(.46)	.9(.31)	.65(.67)	.40(.68) 31%	.25(.64) 28%	.65(.93) 50%
Group C (n=10)	1.33(.59)	1.45(.83)	1.1(.79)	1.0(.79)	.30(.73) 21%	.10(.45) 9%	.40(.68) 28%
	0.20 DF = 2 P = 0.905	8.64 DF = 2 P = 0.013	0.80 DF = 2 P = 0.671	1.81 DF = 2 P = 0.404	.36 DF = 2 P = 0.836	.93 DF = 2 P = 0.628	0.98 DF = 2 P = 0.613

χ^2 = Observed value of the Kruskal- Wallis statistic; Df=degrees of freedom; P=p value

Table 4: Reduction in dentine hypersensitivity response to tactile stimulation (TS) in the three treatment groups from 15 min. to day 7 (end of the study)

Treatment	15 Min Mean(SD)	30 Min Mean(SD)	2 Day Mean(SD)	7 Day Mean(SD)	Reduction (15Min- 2 day) Mean(SD)	Reduction (2 day-7 day) Mean(SD)	Reduction (15min-7day) Mean(SD)
Group A (n=10)	1.05(.88)	.75(.91)	.65(.59)	.50(.51)	.40(.75) 38%	.15(.36) 23%	.55(.68) 52%
Group B (n=10)	1.30(.73)	1.05(.39)	.60(.50)	.20(.41)	.70(.80) 54%	.40(.59) 67%	1.10(.85) 85%
Group C (n=10)	1.40(.68)	.90(.85)	.95(.82)	.70(.92)	.45(.68) 32%	.25(.63) 26%	.70(.73) 50%
	1.85 DF = 2P = 0.397	2.68 DF = 2 P = 0.262	1.66 DF = 2 P = 0.436	3.45 DF = 2 P = 0.178	2.05 DF = 2 P = 0.358	1.94 DF = 2 P = 0.380	4.88 DF = 2 P = 0.087

χ^2 =Observed value of the Kruskal- Wallis statistic; Df=degrees of freedom; P=p value

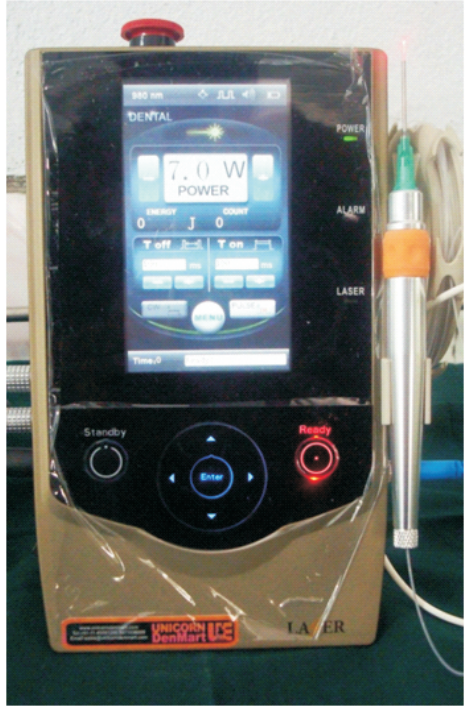

Figure: Laser

Figure: Demonstration Of Brushing Technique

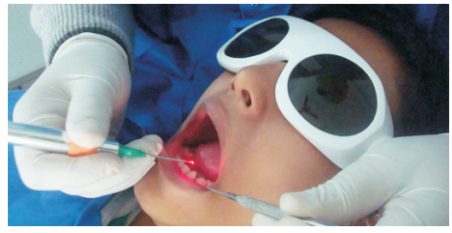

Figure: Application Of Diode Laser

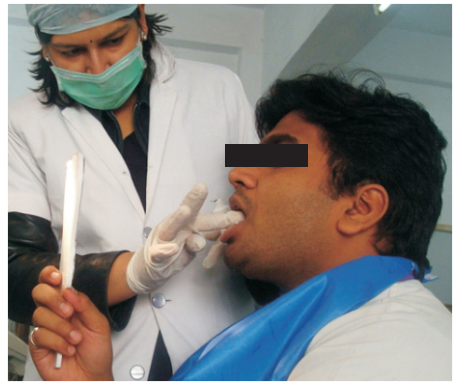

Figure: Gel Application

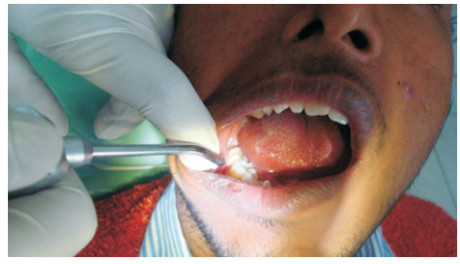

Figure: Evaporative Stimuli

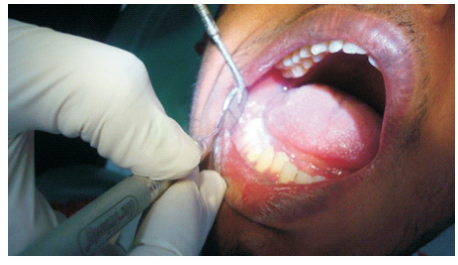

Figure: Tactile Stimuli