

KEYWORDS :Dentin hypersensitivity, Diode laser, CPP-ACP.

INTRODUCTION

Dentin hypersensitivity, the "common cold of dentistry" is a prevalent oral problem affecting more than 40% of adults worldwide.¹ Dentin hypersensitivity (DH) is 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."² The prevalence of dentinal hypersensitivity ranges from 2.8% to 74%.^{1,2,3} The most commonly affected area of cervical dentinal hypersensitivity is premolar region.³ Common factors responsible for dentin hypersensitivity are abrasion, abfraction, parafunctional habits or occlusal disequilibrium; erosion, anatomic predisposition, improperly controlled dentinal acid conditioning.^{4,5,6}

by laser alone and the least was shown by CPP-ACP alone. Laser efficiency was better than CPP-ACP.

Among the various theories proposed regarding the mechanism of dentin hypersensitivity, the most widely accepted Brannstroms hydrodynamic theory states that external stimuli cause fluid movement inside the dentinal tubules and promote mechanical deformation of nerve endings at the pulp/dentin which will be transmitted as a painful sensation.⁷ Based on this theory, the two chief methods proposed to treat dentin hypersensitivity are tubular occlusion and blockage of nerve activity.⁸

Conventional therapies for DH are based on the topical use of desensitizing agents either at home or professionally. The most commonly used agents for dentinal hypersenstivity are protein precipitants, tubule occluding agents, tubule sealants, remineralizing agents and lasers.⁹

Remineralising agent GC Tooth Mousse contain unique complex of Amorphous Calcium Phosphate (ACP) and Casein Phospho–Peptide (CPP) is recommended in dentin hypersensitivity reduction due to its ability to block opened dentinal tubules.¹⁰

Laser therapy was first introduced as a potential method for treating dentinal hypersensitivity in 1985.¹¹ Pashley suggested that laser reduces sensitivity by sealing the dentinal tubules through coagulation and protein precipitation of the plasma in the dentinal fluid or by alteration of the nerve fiber activity.¹² Kimura et al showed that diode laser at 830 nm produces analgesic effect by blocking the depolarization of C-fiber afferents.¹³ A scanning electron microscopic study conducted by Guntakala et al observed that combination of diode laser and desensitizing agent provides better occlusion of dentinal tubules when compared with the use of desensitizing toothpastes alone.¹⁴ The results of various studies concluded that combination of laser irradiation with application of specific desensitizing agents for the management of DH could be an additional therapeutic option with the treatments.^{940,11}

There are no clinical trials evaluating the desensitizing efficacy of combination of a diode laser with CPP-ACP. Hence, it was considered worthwhile to assess the efficacy of combination of a low-level laser therapy with CPP -ACP in providing relief from dentin

hypersensitivity and to help the clinician choose the most effective and long standing treatment solution for dentin hypersensitivity.

Hence, the aim of this study was to compare the clinical effectiveness of diode laser and desensitizing agent (CPP-ACP) on cervical dentin hypersensitivity using visual analog scale (VAS).

METHODOLOGY

The present study included patients in the age group of 20-50 years, visiting the Department of Conservative Dentistry and Endodontics with complaint of cervical dentinal hypersensitivity. Thirty teeth were chosen from 18 patients and were randomly assigned to one of the test groups. Ethical clearance was obtained from the Institutional Review Board in addition to written consent from the patients. Teeth with cervical dentinal hypersensitivity caused by gingival recession or cervical abrasion/erosion with a preoperative VAS score of ≥ 2 were included in this study. Teeth with caries, defective restorations, occlusal restorations, and chipped teeth, deep periodontal pockets (probing depth >6 mm), periodontal surgery within the previous 3 months, and subjects with orthodontic appliances or bridge work, cervical defect >2 mm horizontally, use of desensitizing toothpaste in the last 3 months, patients allergic to ingredients used in the study, any gross oral pathology, patients with any systemic diseases, pregnancy and lactation were excluded from the study.

Procedure

Sensitivity of each tooth was assessed by means of thermal and evaporative stimuli. A blast of air was applied with an air syringe for 1-2 sec at a distance of 1 cm from the tooth surface. Stimuli was applied on the cervical region of the experimental teeth and the adjacent teeth was isolated with cotton rolls. The degree of hypersensitivity reported by the participant was determined according to the Visual analogue scale. The VAS is a 10 cm line with the anchor words "no pain" (0 -cm) and "intolerable pain" (10-cm) at opposite ends. Each patient was asked to place a vertical mark on the VAS to indicate the intensity of his or her level of sensitivity after receiving stimuli. After recording the initial scores, the patients were randomly assigned to one of the treatment groups.

Group 1(n=10): CPP-ACP containing toothpaste (GC Tooth Mousse) was applied on the cervical area of teeth for 3 min after removal of debris and calculus.

Group 2(n=10): Cervical area of tooth was irradiated with a low-level GaAlAs laser, emitting 830 nm wavelength. The laser tip was used as close as possible with the tooth surface without contact and was directed perpendicular to tooth surface at three points: one apical and two cervical points (one mesiobuccal and one distobuccal). Each area was irradiated for 1 min (total of 3 min per tooth).

Group 3- Diode laser irradiation for 3 min followed by application of CPP-ACP containing toothpaste for 3 min.

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After the treatment in each group sensitivity scores were recorded, immediately and 1 week after the therapy. The patients were instructed not to rinse, eat or drink for 30 minutes after the treatment and to avoid using any other professionally or self-applied desensitizing agent in the course of the investigation. The VAS scores were statistically analyzed using ANOVA and post hoc tests.

RESULTS

All three treatment protocols were effective in reducing cervical sensitivity in varying degrees. Group 2 and group 3 showed complete elimination of cervical sensitivity on immediate post operative analysis whereas only group 3 could sustain the complete elimination of sensitivity after 1 week follow up. Group 1 showed reduction in VAS score immediately as well as 1 week following therapy but the sensitivity scores were higher than the other 2 groups. VAS scores in group 2 and group 3 showed statistically significant difference at different time intervals. The VAS scores between group1, group 2 and group 3 were statistically significant in the immediate post operative and after one week follow up period.



Graph 1- Comparison of VAS scores of different groups at 3 different time intervals

Table 1- Table I: Mean and standard deviation values of the various groups at different time intervals

Descriptive Statistics					
	Ν	Minimum	Maximum	Mean	Std.
					Deviation
CPP_Baseline	10	2	7	5.00	1.886
CPP_immediate_post op	10	0	7	3.40	3.098
CPP_one week	10	0	7	3.80	2.936
Laser_baseline	10	3.00	7.00	5.1000	1.37032
Laser_immedite_post op	10	.00	.00	.0000	.00000
Laser_oneweek	10	0	1	.30	.483
Combination_baseline	10	2.00	7.00	4.6000	1.71270
Combination_immediate	10	.00	.00	.0000	.00000
post-op					
Comination one week	10	.00	.00	.0000	.00000

DISCUSSION

Dentine hypersensitivity is a common painful condition which is difficult to solve. Despite the fact that a large variety of treatments exist for DH, none of these treatments are proved to be an ideal and dental practitioners are still confused about the treatment.¹⁵ Any material that can result in a decrease of dentine permeability by occluding tubules would be capable of reducing the symptoms of dentine hypersensitivity clinically.¹⁶ Therefore, the present study was designed to find out the best and long standing treatment modality for DH.

Results of the current study showed maximum desensitizing potential with combination therapy using laser and CPP-ACP followed by diode laser alone and the least was shown by CPP-ACP after 1 week follow up. Even though both group 2 and group 3 showed complete elimination of cervical sensitivity immediately following the treatment, group 2 failed to produce the same desensitizing potential after 1 week following the treatment. The immediate analgesic effect observed following laser irradiation in this study is in supportive of the findings of Brugnera Júnior et al.¹⁷ Study conducted by Yilmaz et al. concluded that, GaAlAs laser therapy is effective in the treatment of DH, and is a more comfortable and faster treatment than traditional treatments for DH.7 Similar to this study, the present study also obtained faster desensitizing effect following laser irradiation. Liu et al. proposed the mechanism of desensitization using laser is by sealing the dentinal tubules thus achieving a good level of analgesia. The closure of dentinal tubules, prevents internal communication of dental pulp with oral cavity fluids and thereby producing the effect.¹⁸

According to Myers & McDaniel's study laser energy can also interfere with the sodium pump mechanism, changes the cell membrane permeability and can temporarily alters the endings of the sensory axons.19 Treatment effectiveness of dentinal hypersensitivity using laser ranges from 53.3%-94.2%.20 However compared with conventional approaches, laser treatment has a disadvantage of decreasing its effectiveness over time that limit its clinical utility. The decreased effectiveness of group 2 observed after 1 week following the therapy in the present study is in supportive of these studies.

The lack of long standing desensitization potential of the current desensitizing agents led to the application of combination therapy for DH. Hence the present study compared effectiveness of laser and CPP-ACP combination for treating cervical dentinal hypersensitivity. Lopes et al. assessed the efficacy of various protocols for treating dentine hypersensitivity and concluded that all desensitizing protocols are effective in reducing dentine hypersensitivity, but the combination of protocols are considered as a better treatment option for long standing effect.²² The current study also showed long standing desensitization potential with combination therapy (laser and CPP-ACP). The prolonged effect of combination therapy obtained in the present study is in supportive of study conducted by Guntakala et al wherein better occlusion of dentinal tubules was observed on SEM analysis using combination therapy.¹⁴ Liu et al also proposed that combination of laser with chemical agents can enhance treatment effectiveness by more than 20% compared to laser treatment alone.¹

The least desensitization potential was observed for CPP-ACP (G.C.Tooth Mousse) group at all time intervals. Results of the current study is in accordance with study by Bhandary et al who stated that GC tooth mousse requires repeated application for its effectiveness since its treatment is short lived and requiring a home based treatment too.² Study conducted by Poitevin et al observed that CPP-ACP complex showed remineralising potential only at the end of 21 days.² G.C.Tooth Mousse was developed by Prof Reynolds at the University of Melbourne in 1998. It act as a reservoir of ACP and provides phosphate ions which favors remineralization. calcium adhesion of the CPP-ACP complexes to the dentinal surface relies on ability to dissolve in aqueous solutions, such a saliva, that its combined to the adhesive nature of the CPP allows the CPP-ACP nanocomplexes to locate over the dentinal surface.^{26,27,28} The negatively charged residues of the CPP are attracted to the exposed positively charged apatite crystals on the surface allowing the CPP adsorption and the release of calcium, phosphate and fluoride ions. The release of these ions onto the dentinal surface has a remineralising effect by the formation of fluorapatite crystals precipitate, occluding the open dentinal tubules.2

Since dentin hypersensitivity has multifactorial etiology and generally more than one factor is found associated, more than one treatment method should be used to desensitize the dentin to satisfactory levels. Further clinical studies with a longer follow up period are required to determine the long term effect of these treatments.

CONCLUSION

- 1. All test groups were effective in reducing cervical dentinal hypersensitivity in varying degrees.
- Maximum long standing efficacy was obtained using combination therapy of laser and CPP-ACP followed by laser alone and the least was shown by CPP-ACP alone.
- Group 1 (CPP-ACP) showed the least desensitizing potential and 3. may require repeated application for its effectiveness.

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