TPM Vol. 32, No. S5, 2025
ISSN: 1972-6325
https://www.tpmap.org/

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COMPARISON OF LASER WITH GRAPHITE PASTE AND CYANOACRYLATE IN THE MANAGEMENT OF DENTINAL HYPERSENSITIVITY

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ABSTRACT

Background: Various treatment options are available for Dentin hypersensitivity (DHS). It is one of the common dental conditions for which the patient seeks treatment. Among these treatment methods, Lasers and Cyanoacrylate are recently under investigation.

Aim and objectives: To compare the clinical efficacy of Cyanoacrylate and Laser in treatment of Dentinal Hypersensitivity.

Material And Methods: The present split mouth study was conducted on 15 patients with dentinal hypersensitivity and those who are willing to undergo treatment. Two treatment approaches; Test group- LASER with graphite paste, and control group- Cyanoacrylate, which was used on either side of the maxillary and mandibular arches randomly. SCHIFF Sensitivity Index was recorded at different time intervals; immediate postoperative period, one week, two weeks post operatively.

Results: The mean SCHIFF scores in both the groups reduced gradually with time postoperatively. The mean SCHIFF scores at immediate post-op was lesser in the laser group than in the Cyanoacrylate group. However, no difference was noted at 1st and 2nd post-op week. The differences were statistically significant.

Conclusion: In conclusion, both LASER with graphite and Cyanoacrylate are equally efficacious and produce better results in reduction of pain and sensitivity. However, Cyanoacrylate being easily accessible, low cost and requires minimal operator skills outstands the comparison.

Keywords: Dentin hypersensitivity; LASER, Low-level Laser; Cyanoacrylates; Graphite paste

INTRODUCTION

Dentin hypersensitivity (DHS) is one of the common dental conditions for which the patient seeks treatment. Stimuli like thermal, mechanical, osmotic, or chemical elements provokes sharp pain from the exposed dentin which occurs as a loss of enamel with or without recession of the gingiva.[1]

Globally, the pooled prevalence rates of DHS ranges from 3 to 98 %.[2] This wide range in the prevalence can be due to the wide spectrum of treatment options consisting of over-the-counter home-care approaches to in-office treatment by dental professionals. Hence, there are chances of under or over reporting.[2]

An array of material and methodology are done in in-office therapy of DHS; mainly focusing on cause rated therapy. For enamel denudation and dentin exposure, nerve desensitization, precipitation, or plugging agents have been performed. For attachment loss, methods to treat gingival recession are followed.[3,4]

Laser application has been done in almost all fields of dentistry. Nonetheless, Among different lasers used in dentistry, Low-level lasers are applied for the treatment of DSH.[5] Laser seals the dentinal tubules. Studies have reported that this modality increases the metabolic activity of the cells of dentin especially, odontoblasts, leading to reduction of DSH.[6] However, laser assisted DSH treatment are expensive and requires operator skills.

Literature reveals that Cyanoacrylate when used in the management of DSH has produced promising results. The key point is that Cyanoacrylate have reduced DHS in shorter periods compared to few other modalities.[7,9] It blocks the dentinal tubule and declines the response to stimuli.[9]

The availability of a wide number of treatment options for the management of DSH is an obstacle to clinical professionals in choosing the right treatment. Hence the present study aims to analyze and compare the efficacy of Laser and Cyanoacrylate in treating Dentinal Hypersensitivity. Additionally, we aim to assess the use of graphite paste (ARTGRAF) benefits as an adjunct to LASER due to the potential hazards of diode laser on pulp.

MATERIALS AND METHODS

Study design, setting, and duration:

The present split mouth study was conducted on Patients who visited the Department of Periodontology and Implantology, Sree Balaji Dental College and Hospital, Chennai during March 2023 to April 2024. Institutional Ethics Committee approval was obtained before commencement of the study. **(ethical committee number).**

Study population:

The study included a total of 15 patients who were willing to undergo treatment for dentin hypersensitivity. Two treatment approaches; Test group- LASER with graphite paste, and control group- Cyanoacrylate, which was used on either side of the maxillary and mandibular arches randomly.

Selection Criteria:

Systemically healthy patients with generalized dentinal hypersensitivity with >20 permanent scorable teeth, non carious cervical lesions, and who consented by signing an informed consent form (ICF) prior to the study, were included. Patients with history of using desensitizing agents, and with severe carious teeth were excluded from the study.

Study procedure:

SCHIFF Sensitivity Index was recorded for the subjects before the procedure. On the test site, graphite paste (ARTGRAF, water soluble) was mixed with distilled water and applied over the sensitive site. Following which, diode LASER (BIOLASE) (940 nm, with non-initiated tip in non-contact mode of 1w power with continuous mode) was used to irradiate the site until the graphite paste gets removed from the tooth surface.(Fig 1) On the other side of the same subjects Cyanoacrylate (XOIN- N-Butyl-2-Cyanoacrylate) was applied with applicator tips (time).(Fig 2)

The same procedure was repeated for 2 consecutive times for every 48 hours. **SCHIFF Sensitivity Index** was recorded at different time intervals; immediate postoperative period, one week, two weeks post operatively. (Table 1)

Statistical analysis:

The collected data was compiled into a Microsoft Office Excel worksheet and then subjected to statistical analysis using SPSS software.

RESULTS

The mean SCHIFF scores in both the groups reduced gradually with time postoperatively. The mean SCHIFF scores at immediate post-op was lesser in the laser group than in the Cyanoacrylate group. Interestingly, no differences were noted at 1st and 2nd post-op week. The differences were statistically significant. (Table 2)

DISCUSSION

DSH is rather painful caused by a variety of stimuli. Various theories have been put forward to describe the transmission of pain stimuli in DSH. The widely accepted theory is hydrodynamic theory. According to which activation of A-δ nerve fibers which are frequently located on the dentinal tubules are activated. sudden movements of fluid in and out of the dentinal tubules cause activation of A-δ fibers. The provoke of sharp pain associated with sensitivity is due to subsequent activation of dentinal tubules, and this activation has been positively correlated to the presence of opened or occluded tubules.[10-14]

In the current investigation, we observed a reduction in sensitivity in both the treatment groups. There was no statistically significant difference between the Cyanoacrylate and laser group in terms of clinical effectiveness. Thus our results suggest that both modality interventions are capable of reducing the pain and sensitivity in DSH and can be used by the clinician.

Similar to the present study, Lima et al[12] reported that the quality of life improved in both Cyanoacrylate and laser group. However, we have used SCHIFF scoring methodology which uses application of compressed air from a three way dental syringe at 1 cm distance for 1 second. Lima et al had used the OHIP-14 questionnaire which depends on self evaluation rather than a method which replicates pain provoking scenarios.[12]

The results of Flecha et al[8] were similar to the present study. The authors had concluded that laser was equally efficacious to Cyanoacrylate in the management of DSH upto sixth month postoperatively. But they had used an air-jet and cold spray test to evaluate the responses. [8]

Cyanoacrylate is a glue-like in nature and thereby it blocks the open dentinal tubules in DSH. Application of Cyanoacrylate in DSH is advantageous as it is easily available, inexpensive, biocompatible, ease of application and less time consuming. [15]

LASERS on the other hand, have opened a new dimension in the management of DSH. Laser irradiation causes melting of the tubules, and thereby obliteration of dentinal tubules. The fluid movements in the tubules are minimized due to evaporation of the fluid in the dentin. Lasers also provide analgesic effects by decreasing the conduction capacity of the nerve. [16-18]

For DSH management, few Studies have reported that the Nd: YAG laser and the diode laser; both low and high powered, are effective. Laser therapy for DSH is extremely safe and produces more comfortable, faster, and effective results. [19,20] However, expense of the separate instrument, increase in pulpal temperature and requirement of skilled operators are the limitations.[20]

A systematic review by Cattoni et al[23] reported that Lasers in treatment of DSH can be used alone or along with other specific materias.[23] In the present study, we have used graphite paste i.e. by mixing graphite powder with water. Laser irradiation on the surface of the tooth causes heat generation which raises the pulpal wall temperature. Graphite being a dark pigment, limits the transmission of the laser light to the pulp, and there is possible reduction of unwanted side effects on the dental tissues.[21]

An in-vivo study had concluded that graphite paste evaporated completely during irradiation with Laser and never penetrated into the dentinal tubules. This is because graphite particle size is approximately 5–25 microns which is sufficiently larger than the normal dentinal tubules size.[22]

The noteworthy findings of the present study is that both LASER with graphite and Cyanoacrylate are equally efficacious and produce better results in reduction of pain and sensitivity. However, Cyanoacrylate being easily accessible, low cost and requires minimal operator skills outstands the comparison.

CONCLUSION

The treatment of dentinal hypersensitivity is a challenge to oral clinicians. We suggest that both the treatment options have better effects in treatment of dentinal hypersensitivity. Cyanoacrylate is an easily available, low cost product that can be a better option when compared to Laser. The Laser, which is commonly used in dental practice nowadays, when used alongside with graphite paste can reduce the undesirable side-effects of Laser. Studies with larger samples, different types of laser, and longer follow up should be considered for better reliable results.

Table 1; Schiff's Sensitivity Index Interpretation

Scores	**Interpretation**
0	Tooth/subject did not respond to the air stimulus

1	Tooth/subject responded to the air stimulus but did not request discontinuation of the stimulus
2	Tooth/subject responded to the air stimulus and requested discontinuation or moved from the stimulus
3	Tooth/subject responded to the air stimulus, considered the stimulus to be painful, and requested discontinuation of the stimulus

Table 2; Intergroup and Intragroup Comparison of SCHIFF scores in two groups at different time intervals

Groups	**Time period**	**SCHIFF scores**		Independent T test
		Mean	**SD**	**P value**
LASER	Baseline	2	0.755	0.02*
	Immediate post-op	0.733	0.703	
	1st week	0.466	0.639	
	2nd week	0.266	0.457	
Cyanoacrylate	Baseline	2	0.755	0.04*
	Immediate post-op	1	0.507	
	1st week	0.4	0.507	
	2nd week	0.266	0 507	
ANOVA	P value	0.025*		

Figure 1; Management Of DSH in Laser group (a) pre-op, (b) Application of gingival dam, (c) Graphite application, (d) Irradiation with Laser light of 940 nm, with non-initiated tip in non-contact mode of 1w power with continuous mode

Figure 2; Management Of DSH in Cyanoacrylate group (a) pre-op picture, (b) b)Application of Cyanoacrylate gel, (c) Immediate Postoperative picture

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