Original Research Paper

Volume-9 | Issue-8 | August - 2019 | PRINT ISSN No. 2249 - 555X

Dental Science

# COMPARITIVE ANALYSIS OF LOW LEVEL LASER THERAPY AND IONTOPHORESIS IN MANAGEMENT OF DENTINAL HYPERSENSITIVITY: A RANDOMIZED CLINICAL TRIAL

| | |
|---|---|
| **Dr Ejya Sharma** | MDS,Consultant,Periodontist And Oral Implantologist |
| **Dr Stuti Gupta*** | Lecturer,Department Of Periodontology,School Of Dental Sciences,Sharda University. *Corresponding Author |
| **Dr Shradha** | MDS,Consultant,Periodontist And Oral Implantologist. |
| **Dr Deepak tanwar** | MDS,Oral and maxillofacial suregon,Consultant and Private Practitioner |

ABSTRACT **BACKGROUND:** The purpose of this clinical study was to compare the efficacy of low level laser therapy and iontophoresis for the treatment of dentin hypersensitivity.

**METHOD:** Ten patients aged 20-40 years with the complaint of dentinal hypersensitivity atleast in two teeth were selected for the 4 week study. Target sites were randomly divided into two groups, Group A: Diode laser 980nm and Group B: iontophoresis with 1.23% APF gel. The sensitivity was then evaluated with 3 stimulus tests that is the tactile test by dental explorer, air blast test by 3 way syringe and cold water test. The responses of the patients towards the sensitivity tests were evaluated on the Verbal Rating Scale of 0-3. The data was thereafter statistically analyzed.

**RESULTS:** Statistically significant reduction in dentinal hypersensitivity was seen in both groups at subsequent weeks compared to baseline when assessed for intra group but inter group analysis didn't show any significant results.

**CONCLUSION:** Both the treatment modalities were equally effective and can be effectively used for the treatment of dentinal hypersensitivity.

**KEYWORDS :** Diode Laser,LLLT,Iontophoresis,Hypersensitivity

## INTRODUCTION

Dentinal hypersensitivity is defined as a short, exaggerated, painful response evoked when exposed dentin is subjected to chemical, mechanical, or thermal stimuli[1]. The property of exposed dentinal tubules has been demonstrated to consequentially increase dentine permeability and is attributing to pain and sensitivity [2]. The hydrodynamic theory proposed by Brännström Aström in 1964 is the most acceptable theory elucidating pain of dentine hypersensitivity[3]. Dentinal hypersensitivity (DH) has been shown to peak in 20 to 30 year olds and rise again in the 50s age group. It is estimated that one in seven patients at some point in their life suffer from some degree of dentin hypersensitivity. Facial surfaces of teeth near the cervical aspect are generally involved. Patients with attachment loss and those undergoing periodontal treatment are particularly susceptible to such condition because of recession following periodontal surgery or loss of cementum following non-surgical periodontal therapy[4].

The exposure of dentin to external environment can be caused by loss of tooth surface from occlusal wear and parafunctional habits i.e. attrition, abrasion, erosion by acids and abfractions. Various periodontal diseases, periodontal surgeries and faulty tooth brushing habits could lead to gingival recession which in turn causes hypersensitivity, as cementum is comparatively thin, less hard than enamel and is easily removed by scaling, abrasive pastes and toothbrushing[5].

Grossman[6] suggested a number of pre requisites for the treatment of dentinal hypersensitivity. Therapy should be non irritating to pulp, painless on application, easy to carry out, rapid in action, effective for a prolonged period, with minimal or no staining and consistently effective.

Based on the hydrodynamic theory, the ideal treatment for DH should aim at reducing fluid flow within the dentinal tubules or block the pulp nerve response[7]. Accordingly, several approaches have been proposed for in-office DH therapy, which includes desensitizing agents [8], iontophoresis, adhesives, and resins[9].

Lasers have been recently proposed for the in-office treatment of DH. The exact mechanism of action of lasers in DH although is not clearly understood, however several theories have been proposed. For low-intensity lasers (*e.g.*, GaAlAs), the irradiation may have a photo-bio-modulating effect on cellular activity, enhancing the buildup of tertiary dentin by odontoblastic cells [10]. Middle-output-power lasers (*e.g.*, Er: YAG, Nd: YAG, and Er, Cr: YSSG) may obliterate the dentinal tubules [11]. For Er: YAG and Er, Cr: YSSG, the efficacy in reducing DH may be attributed to the thermo-mechanical ablation process and to superior absorption of their wavelengths by water[12, 13]. These effects may result in the evaporation of the superficial layer of dentinal fluid thereby reducing the flow within the dentinal tubules.

In 1747 the method of iontophoresis was delineated by Pivati[14]. The prototypal use of iontophoresis to treat dentinal hypersensitivity began in 1960. The fluoride ion content of APF gel causes formation of calcium – phosphorous precipitates along with calcium fluoride (CaF2) and fluorapatite (FAp) that obstruct the dentinal tubules thus awaiting permeability.

Iontophoresis and LASER have been used to study their effect in dentinal hypersensitivity. However there is no published data to the best of our knowledge on comparative investigation done The primary aim of this randomized controlled clinical study was to comparatively assess the efficacy of Diode laser (980nm) and 1.23% APF gel iontophoresis in the treatment of dentinal hypersensitivity.

## MATERIALS AND METHOD:

This randomized, split mouth design clinical trial compared two treatment modalities, namely, iontophoresis using APF gel and Diode laser and was conducted in the Department of Periodontology, ITS Dental College, Hospital and Research Centre. 10 subjects (3 females and 7 males), with an average age range of 30-69 years were consecutively recruited into the study based on the inclusion criteria: 1) Patients reporting with chief complaint of tooth hypersensitivity; 2) no recent history of any desensitization treatment; 3) absence of systemic disease; and 4) desire to participate in the study for a period of 4 weeks.

The study was approved by the institutional ethics research committee (letter no IEC/PERIO/11-B/14 dated 20th Nov 2014) and was conducted in accordance with the 2013 revision of the Helsinki's declaration of 1975.[15]

Subjects having hypersensitivity because of carious, fractured or restored teeth, undergoing orthodontic therapy, using desensitizing agents, pregnant and lactating women and subject with unshielded cardiac pacemaker and abutment teeth for prosthesis were excluded from the study.

Informed consent was taken from all the enrolled subjects. The potential target sites were isolated with cotton rolls and sensitivity was evaluated with 3 stimulus tests, that is, tactile test by dental explorer, air blast test by 3 way syringe (the air jet stimulus ≥ 5 with moderate or intense discomfort) and cold water test.

Allocation of intervention was done randomly as per random.org[16].

Each of these tests was performed at a time gap of 5mins for a time period of 5 seconds..

Tactile test: Dental explorer (no 17/23 using no 17 side) was gently run across the affected surface of the tooth.

Air blast test: A blast of air at a distance of 3- 4 mm from the cervical region of teeth from a 3-way dental syringe of dental chair.

Cold water test: Ice cold water was slowly expelled onto the tooth surface with disposable syringe.

Verbal Rating Scale (VRS) Scale was used to evaluate the response to sensitivity tests which included
Grade 0: No pain/ discomfort,
Grade 1: mild pain/discomfort,
Grade 2: moderate pain and
Grade 3: with intense or unbearable pain.

Target sites were randomly divided into two groups, Group A: Diode laser 980nm and Group B: iontophoresis with 1.23% APF gel.

Group A diode laser (Photon plus 10 Watt Soft Tissue Diode Laser from Zolar Technology & Mfg Co. Inc) – The tooth surface to be desensitized was isolated with cotton rolls, all necessary precautions were taken. After that Diode laser was used in non contact mode with energy set up of 0.5 W and 62.2J/cm2 for 60 seconds per tooth surface as per the guidelines provided by the manufacturer.

Group B Iontophoresis (JONOFLUOR SCIENTIFIC ® Art. cod. 016-3 Dimensions: W18xL18, 7xH7, 2 cm) – The selected tooth surface was dried and isolated, APF gel was applied. The iontophoresis circuit was completed and gradually increasing current was applied until the subject complained of pain or sensitivity. That value was marked as the threshold level. APF gel was reapplied and iontophoresis was done at a lower ampere current for 60 seconds per tooth surface as per the guidelines of the manufacturer. Teeth were evaluated for dentinal hypersensitivity with all three tests at baseline; week after week till three weeks.

Statistical Analysis: Validation of clinical outcomes of iontophoresis versus diode laser treatment was carried out by Tukey-Kramer Multiple Comparisons test and Unpaired t test. Data was summarized by calculating the mean and standard deviation. P values of < 0.05 were considered statistically significant.

## RESULTS

Intra-group analysis was done using Tukey-Kramer Multiple comparisons test in both the groups. There was reduction in dentinal hypersensitivity at subsequent weeks compared to baseline and the reduction was statistically significant in both the groups. However when the result obtained were compared the differences were statistically non significant.(Table 1)

The intergroup comparison was done by Unpaired t test. The differences in the reduction in dentinal hypersensitivity in both the groups after first, second and third week following the desensitization procedure, were statistically non significant which suggested that both the treatment modalities were equally effective for treating dentinal hypersensitivity. (Table 2)

## DISCUSSION:

There is limited published information related to use of iontophoresis compared to diode laser in treatment of dentinal hypersensitivity. The present study demonstrated a perceptible reduction in symptoms of dentinal hypersensitivity from baseline to the weekly evaluation upto 3 weeks employing both techniques. Despite a multitude of therapeutic options targeting dentinal hypersensitivity it poses as a distressing clinical dilemma prognosis. Newer techniques such as iontophoresis were to address developed dentinal hypersensitivity aiming at long term relief.

Several hypotheses have been advanced to explain the desensitization by iontophoresis. One, involves the formation of reparative dentin subsequent to application of current to dentin, the sequel to which is dead tract formation. The second mechanism is that electrical current aids in attaining paresthesia by altering the sensory mechanism of pain conduction and the third is that it probably causes microprecipitation of calcium fluoride that may impede the hydrodynamically mediated stimuli that induce pain.[17] A study by McBride et al [18] established that iontophoretically treated teeth had a fluoride concentration twice that of those subjected to topical application and 20 times that of control teeth. According to present study, iontophoresis can be effectively used for dentinal hypersensitivity. Aparna et al. in 2010[19] compared APF gel iontophoresis with dentin bonding agent for desensitization. Though no statistically significant differences were ascertained by the results of both the groups, it was concluded that APF gel iontophoresis is more effective for treating dentinal hypersensitivity compared to dentin bonding agent.

Diode laser is a soft tissue laser with wavelength ranging from 655nm to 980nm. Diode laser at different wavelength of 780,790, 830, and 900 nm have been studied by various authors for desensitization, however very few studies have been published which employ 980nm wavelength for dentinal hypersensitivity management . Diode laser leads to increase in mitochondrial ATP through biostimulation, inflates pain threshold of free nerve ending, provides analgesic effect because of increase in endorphine levels. It also inhibits cyclo-oxygenase enzyme pathway thereby diminishing the pain transmission by glutamate or substance P. There is also an observed formation of secondary dentin by odontoblast due to biostimulation.[20] A study by Ladalardo *et al.* [21] compared the efficacy of two types of lasers in individuals with sensitive teeth and their pain, evaluation was done prior to and after treatment. A 660nm red laser was reported to have greater desensitising effect than the 830nm infrared laser.

The nature of tissue reaction response occurring varied according to the active medium, wavelength and power density of the laser and also the optical properties of the target tissue. However, it is also hypothesized that soft tissue diode laser type, mediates an analgesic effect that is analogous to depression of nerve transmission by blocking the depolarisation of afferent nerves.[22]

A mechanism of action akin to both Iontophoresis and laser based treatments is based on the up-regulation of either tertiary and/or peritubular dentinogenesis. Thus affecting the occlusion of dentinal tubules, permeability and the transmission of stimuli during dentine hypersensitivity episodes[23]. The limitation of the present study to evaluate obstruction of dentinal tubules to histologically evaluate was not performed due to ethical reasons ,further a 3 week follow up of patients is a relatively short time period to assess long term stability of results achieved. Further studies consisting of a larger sample size and a prolonged follow up period are warranted to assess the comparative efficacy of iontophoresis and laser based treatments in the management of this disturbing clinical condition named dentinal hypersensitivity.

## CONCLUSION:

Both the treatment modalities showed significant reduction in sensitivity immediately after procedure, at 1 week and 3 week follow up compared to the baseline. The implication of diode laser as well as iontophoresis procedures to control and abet hypersensitivity could act as useful modalities in clinical settings due to the high prevalence of dentinal hypersensitivity.

TABLE 1: Percentage Reduction In Hypersensitivity Response From Baseline

| | Group | Mean± Standard Deviation | | P value |
|---|---|---|---|---|
| Per ab | Laser | 86.6667 | 21.94269 | 0.075** |
| | Iontophoresis | 60.8333 | 37.27815 | |
| Per cw | Laser | 70.0000 | 17.21326 | 0.649** |
| | Iontophoresis | 65.8333 | 22.72012 | |
| Per ex | Laser | 95.0000 | 15.81139 | 0.407** |
| | Iontophoresis | 85.0000 | 33.74743 | |

TABLE 2:

| Intervals | P Value | Significance |
|---|---|---|
| One | 0..342 | NS |
| First Week | 0.793 | NS |
| Second Week | 0.872 | NS |
| Third Week | 0.665 | NS |

## REFERENCES

1. American Academy of Periodontology. Glossary of Periodontal Terms. 4th Ed, pp 13. Chicago: 2001.
2. Lucchese A, Mongiorgi R, Prati C, Dolci F. Treatment of dentinesensitivity with stannous fluoride gel. Electron microscopic study and evaluation of dentin permeability. Minerva Stomatol. 1997; 46: 659-663.

3. Brännstrom M, Aström A. A study of the mechanism of pain elicited from the dentin. J Dent Rest 1964; 63:619-625.
4. Patricia A Walters. Dentinal hypersensitivity: A review. The Journal of contemporary dental practice. 2005; 6(2).
5. Alessandra et al. Dentin Hypersensitivity– etiology, treatment possibilities and other related factors: A literature review. World Journal of dentistry 2012; 3(1):60-67.
6. Grossman LI. A systematic method for the treatment of hypersensitive dentin. J Am Dent Assoc 1935; 22:592-602.
7. Holland GR, Närhi MN, Addy M, Gangarosa L, Orchardson R. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. J Clin Periodontol 1997; 24:808-813.
8. Lan WH, Liu HC, Lin CP .The combined occluding effect of sodium fluoride varnish and Nd: YAG laser irradiation on human dentinal tubules. J Endod, 1999; 25:424-426.
9. Porto IC, Andrade AK, Montes MA .Diagnosis and treatment of dental hypersensitivity. J Oral Sci, 2009; 51:323-332.
10. Ladalardo TC, Pinheiro A, Campos RA, Brugnera Júnior A, Zanin F, Albernaz PL. Laser therapy in the treatment of dentine hypersensitivity. Braz Dent J, 2004; 15:144-150.
11. Sgolastra F, Petrucci A, Gatto R, Monaco A .Effectiveness of laser in dentinal hypersensitivity treatment: a systematic review. J Endod 2011; 37:297-303.
12. Hossain M, Nakamura Y, Yamada Y, Kimura Y, Matsumoto N, Matsumoto K .Effects of ErCrYSSG laser irradiation in human enamel and dentin: ablation and morphological studies. J Clin Laser Med Surg1999; 17:155-159.
13. Braun A, Jepsen S, Deimling D, Ratka-Krüger P .Subjective intensity of pain during supportive periodontal treatment using a sonic scaler or an Er:YAG laser. J Clin Periodontol 2010; 37:340-345.
14. Green, Philip G. J. Control. Release, 1996; 41(1-2): 33-48.
15. World Medical Association Declaration Of Helsinki Ethical Principles for Medical Research Involving Human Subjects Adopted by the 18th WMA General Assembly, Helsinki, Finland, June 1964, and amended by the: 29th WMA General Assembly, Tokyo, Japan, October 1975
16. www.random.org, last accessed on January 10, 2015
17. Gangarosa LP, Park NH. Practical considerations in iontophoresis of fluoride for desensitizing dentin. J Prosthet Dent 1978; 39:173-8
18. McBride MA, Gilpatrick RO, Fowler LW. The effectiveness of sodium fluoride iontophoresis in patients with sensitive teeth. Quintessence Int 1991; 22:637-40.
19. Aparna et al. Comparative efficacy of two treatment modalities for dentinal hypersensitivity: A clinical trial. Indian J Dent Res 2010; 21:544-548.
20. Karen Cristina Kazue. Low level laser therapy for dentine hypersensitivity. Cienc Odontol Bras 2003; 6: 17-24. |
21. Ladalardo TC, Pinheiro A, Campos RA, Brugnera Junior A, Zanin F, Albernaz PL, Weckx LL. Laser therapy in the treatment of dentine hypersensitivity. Braz Dent J.2004;15(2):144-50.
22. Wakabayashi, H., Tachibana, H. and Matsumoto, K. A clinical study on the hypersensitive dentine by 20 and 40 mW GaAlAs semiconductor laser. Journal of Showa University Dental Society1992; 12: 343-347.
23. Baume, L.The biology of the pulp and dentine. Monographs of Oral Science 1980; 4: 457-463.