

ABSTRACT Aim: To compare the efficacy of Diode laser and 1.23% APF gel iontophoresis for the treatment of dentinal hypersensitivity.

Material and Method: This is a randomized split mouth clinical study. Subjects of age group above 18 years with complain of hypersensitivity in atleast 2 teeth were included in the study. The sensitivity was verified with tactile test, air blast test and cold water test, response to these stimuli were recorded on a verbal rating scale 0-3. A total 30 sites were randomly divided into two groups; Group A (15 sites) — 980nm Diode Laser and Group B (15 sites) — 1.23% APF gel iontophoresis. The teeth were re-evaluated immediately 15min after the treatment, at the end of 1 week and 1month.

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

INTRODUCTION :

Dentinal hypersensitivity is defined as the short, exaggerated, painful response elicited when exposed dentin is subjected to certain thermal, mechanical, or chemical stimuli.⁽¹⁾ The exposure of dentin to external environment can be caused by loss of tooth surface from occlusal wear and parafunctional habits i.e. attrition, tooth brushing abrasion, erosion by acids and abfractions. Various periodontal diseases, periodontal surgeries and faulty tooth brushing habit can lead to gingival recession which in turn causes hypersensitivity, because cementum which is thin and less hard than enamel is easily removed by scaling, abrasive pastes and toothbrushing.⁽²⁾ The hydrodynamic theory proposed by Brännströn Aström in 1964 is the most acceptable theory in explaining the pain of dentine hypersensitivity.⁽³⁾

Grossman suggested a number of requirements for treatment of dentinal hypersensitivity. Therapy should be nonirritating to the pulp, relatively painless on application, easily carried out, rapid in action, effective for a long period, without staining effects, and consistently effective.⁽⁴⁾ To date, most of the therapies have failed to satisfy one or more of these criteria, but some authors report that lasers may now provide reliable and reproducible treatment.⁽⁵⁻⁷⁾

"LASER" is an acronym derived from Light Amplification by the Stimulated Emission of Radiation. The first laser used for the treatment of dentin hyper-sensitivity was reported by Matsumoto et al using Nd:YAG laser in 1985. ⁽⁸⁾ After which many lasers such as CO2, Er:YAG, HeNe, Er,Cr:YSGG have been used for desensitization.⁽⁹⁾ But very few studies are available with 980nm Diode Laser for Dentin desensitization.

The method of iontophoresis was described by Pivati in 1747. Iontophoresis was first used in the early 1960s to treat dentin hypersensitivity. APF gel contain fluoride ions which causes formation of calcium – phosphorous precipitates as well as calcium fluoride (CaF₂) and fluorapatite (FAp) that block the dentinal tubules and decrease the per-

meability and sensitivity.(10)

Hence the primary aim of this clinical study was to evaluate and compare the efficacy of Diode laser (980nm) and 1.23% APF gel iontophoresis for the treatment of dentinal hypersensitivity.

MATERIALS AND METHODS

This randomized, split mouth design clinical trial compared two treatment modalities, namely, iontophoresis using APF gel and Diode laser was conducted in the Department of Periodontology of Govt. Dental College and Hospital, Aurangabad, India.

Thirty sites were randomly divided into two treatment groups. Subjects of age group above 18 years having at least 2 teeth with dentinal hypersensitivity and were systemically healthy, were included in the study while 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 pace maker were excluded from the study.

STUDY DESIGN AND TREATMENT:

Informed consent was taken from the subjects that fulfilled the inclusion criteria. 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 and cold water test. Each of these tests were performed at the time gap of 5mins.

- Tactile test: Dental explorer was gently run across the affected surface of the tooth. (Figure -1a)
- Air blast test: A blast of air from a 3-way dental syringe of dental equipment. (Figure 1b)
- Cold water test: Ice cold water was slowly expelled onto the tooth surface with disposable syringe.(Figure-1c)

Matsumoto's criteria was used to evaluate the response

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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.⁽¹²⁾ Target sites were randomly divided into two groups, Group A : Diode laser 980nm and Group B : iontophoresis with 1.23% APF gel.

APPLICATION OF AGENTS:

Group A diode laser – 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. (Figure 1-d)

Group B lontophoresis – 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 threshold level. APF gel was reapplied and iontophoresis was done at a lower ampere current for 60 seconds per tooth surface. (Figure 1-e)

Teeth were evaluated for dentinal hypersensitivity with all three tests at baseline, 15mins after procedure and again at 1 week & 1 month follow up.

RESULTS & DATA ANALYSIS:

There was decrease in dentinal hypersensitivity in both the groups after 15 mins , 1 week and 1 month follow up compared to baseline. Table no 1 show the average value of data obtained from the subjects to tactile test, air blast test and cold water test at baseline, just after 15mins of the desensitization procedure, 1 week and at 1 month follow up.

Intra-group analysis was done using Tukey-Kramer Multiple comparisons test in both the groups. As shown in table no.2, in group A i.e. Diode laser group there was reduction in dentin hypersensitivity just 15mins after the procedure compared to baseline and the P value was < 0.001 which suggested that the reduction was statistically significant. There was also reduction in dentin hypersensitivity at 1 week and 1 month follow up compared to baseline and the reduction was statistically significant. However when the result obtained immediately 15mins after the procedure was compared to 1week and 1 month follow up, the differences were statistically non significant.

In group B: Iontophoresis group there was reduction in sensitivity just 15 mins after the procedure and at 1 week follow up compared to baseline and theses reductions were statistically significant. But when reduction in sensitivity was compared from 15 mins to 1 week and 1 month follow up, it was statistically not significant.

The intergroup comparison was done by unpaired t test. The differences in the reduction in dentinal hypersensitivity in both the groups at 15 mins after the desensitization procedure, 1 week and 1 month follow up were statistically non significant. Which suggest that both the treatment modalities are equally effective for dentinal hypersensitivity. (Table no.3)

DISCUSSION:

Dentin hypersensitivity occurs due to exposure of terminal end of dentinal tubule to external stimuli. Therefore many treatment modalities aim to block these exposed terminal end. lontophoresis is an electric device and produces electric current once the circuit is completed. By applying the appropriately charged electrical current, ionized drugs can be driven into tissue based on the principle that like charges repel and opposite charges attract. Various hypothesis have been proposed to explain the mechanism of action of iontophoresis. One is that electric current results in dead tract due to formation of reparative dentin. Second is that it alters the sensory mechanism and thus produces paresthesia. Third is that it may block the hydrodynamically mediated stimuli by microprecipitation of calcium fluoride.⁽⁹⁾According to present study, iontophoresis can be effectively used for dentin hypersensitivity. The results obtained were in accordance with the previous studies done by - Modupeola et al 2002 where he compared 2% neutral solution of sodium fluoride using Desensitron II Iontophoresis device with current and the control teeth received the solution on the device without current. He observed that fluoride desensitization with iontophoresis was more effective than topical fluoride application.¹³ Aparna et al. in 2010 compared APF gel iontophresis with dentin bonding agent for desensitization. Though she observed no statistically significant differences in the results obtained in both the groups, she concluded that APF gel iontophoresis is more effective for treating dentinal hypersensitivity compared to dentin bonding agent.⁽⁹⁾

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.⁽⁸⁾ But very few studies are available with 980nm wavelength for dentin hypersensitivity. Diode laser leads to increase in mitochondrial ATP through biostimulation, increases pain threshold of free nerve ending, provide analgesic effect because of increase in bendorphine. It also inhibit cyclo-oxygenase enzyme which causes conversion of arachidonic acid into prostaglandin which in turn increases the pain transmission by glutamate or substance P. There is formation of secondary dentin by odontoblast due to biostimulation.(11) As described in literature, diode laser is easy to apply and has good results. According to present study there is marked reduction in dentinal hypersensitivity with Diode laser. Previous study done by Romeo et al in 2012 supports this result, where he compared 2% NaF+ diode laser with NaF and diode laser and found that maximum reduction in sensitivity was in group of diode laser combined to 2% NaF. Thus he cocluded that diode laser is a useful device for DH treatment if used alone and mainly if used with NaF gel.⁽¹²⁾ Mariana-Ioana Miron et al in 2007 conducted a preliminary study to evaluate the effectiveness of the 980nm GaAlAs high-level diode laser in reducing dentinal hypersensitivity to cold stimuli and concluded that High-level 980 nm GaAlAs diode laser therapy induces a clinical reduction of pain sensitivity.(14)

CONCLUSION:

This study is first of its kind to compare the Diode laser with 1.23% APF gel lontophoresis for dentinal hypersensitivity. Both the treatment modalities showed reduction in sensitivity immediately after procedure, at 1 week and at 1 month follow up compared to the baseline. Therefore, Diode laser and 1.23% APF gel iontophoresis, both can be effectively used for the treatment of dentinal hypersensitivity. Figure 1: a) Tactile test; b) Air blast test; c) Cold water test; d) APF gel lontophoresis; e) Diode laser desensitization







Subjects Excellent	GROUP A DIODE LASER 940 nm					GROUP B IONTOPHORESIS				
C. P.										
	NO NO	BASELINE	AFTER 15 MINS	1 MEX FOLLOW UP	1 MONTH FOLLOW UP	H NO	BASELINE	AFTER 15 MINS	S WEX FOLLOW	1 MONTH FOLLOW UP
		Average			1	Average				
1)	33	0.6	0	0	0					
	34	1.6	0	0	0	44	1.6	0	0	0
	35	1.6	0	0	0	45	1.3	0	0	0
2)	41	2	1.6	1.3	0.6	31	2.6	0.5	0.6	0.6
	42	1.3	0.6	0.3	0.3	32	2	0.6	0.6	0.3
	43	1.3	0.3	0	0	33	1.6	0.3	0	0
	46	1.6	0	0	0	36	1.6	0	0	0
3)	14	3	1	0	0	23	3	2.3	1.6	1
	15	2	1	1	0.6	24	2.6	0.6	0	0
	43	2	0	0	0	33	2	1	1	0.6
	44	3	1	1	0.6	34	3	2	2	0.6
4)						45	1	0	0	0
	16	2.3	0.6	0.3	0.3	46	1.6	0.6	0.3	0
5)	26	1	0	0	0	16	1	0	0	0
	31	2	0.5	0.3		41	3	0.6	0.3	0
	32	1.6	0	0	0	42	2.3	0.6	0	0

Table 1: Average value of data obtained from subjects at baseline, after 15 mins the procedure, 1 week and at 1 month follow up.

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Tukey-Kramer Multiple Comparisons Test						
	Group A		Group B			
	P value	Signifi- cance	P Value	Significance		
Baseline to immediately after 15 min	P<0.001	S	P<0.001	S		
Baseline to after 1 week	P<0.001	S	P<0.001	S		
Baseline to after 1 month	P<0.001	S	P<0.001	s		
Immediately after 15 min to 1week fol- low up	P>0.05	NS	P>0.05	NS		
Immediately after 15 min to 1 month follow up	P>0.05	NS	P>0.05	NS		
1 week to 1 month follow up	P>0.05	NS	P>0.05	NS		

Table no. 2: Intra-group Analysis (S: Significant; NS : Non- Significant)

Inter – group Comparison (Unpaired t test)					
	P value	Significance			
Baseline	0.3835	NS			
After 15 mins	0.7848	NS			
After 1 week follow up	0.8107	NS			
After 1 month follow up	0.661	NS			

Table no. 3: Inter-group Analysis (S: Significant; NS : Non- Significant)



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