ORIGINAL ARTICLE

COMPARISON OF DENTIN HYPERSENSITIVITY MANAGEMENT OF EXPOSED ROOT SURFACES BY DENTIN BONDING AGENT AND THINLY APPLIED GLASS IONOMER CEMENT: A CLINICAL TRIAL

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Background: Dentin hypersensitivity is a common clinical problem all over the world and it is called the common cold of dentistry. This study aimed to compare the efficacy of glass ionomer cement and dentin bonding agent in management of dentin hypersensitivity in patients presenting to Peshawar Dental College. **Methods:** This Quasi-experimental study was conducted on patients presented to the Department of Operative dentistry and Endodontics from February to August 2022.A total of 60 patients in the age range of 18–70 were selected based on convenience sampling. The patients were divided into 2 groups. Group A received glass ionomer cement and Group B received dentin bonding agent. The sensitivity was assessed before treatment using visual analogue scale and documented as baseline reading with both tactile and evaporative stimuli. It was then evaluated immediately after treatment, as well as at 1 week and 6 weeks post-treatment, using the visual analogue scale with tactile & evaporative stimuli. **Results:** Thirty Patients in group A were treated with glass ionomer cement & 30 patients in Group B received treatment with dentin bonding agent. The pain scores in both groups decreased from severe to moderate to mild or no pain immediately after application compared to baseline (p=0.613). During the 1 week follow up, most patients in both groups reported mild or no pain (p=0.64). After 6 weeks, most patients in both groups experienced mild pain (p=0.338). **Conclusion:** Comparison of glass ionomer cement and dentin bonding agent revealed a significant difference in pain scores immediately after application. However, at 1- week and 6-weeks follow-ups, there was no significant difference between the two groups, as most patients reported only mild pain.

Keywords: Dentin bonding agent; Dentin hypersensitivity; Glass ionomer cement

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INTRODUCTION

Dentin hypersensitivity (DH) is one of the most common dental problem and defined as a short sharp pain arising from exposed dentin in response to various stimuli such as thermal, tactile, evaporative, osmotic or chemical that cannot be usually ascribed to any other form, dental defect or pathology.[1]

To elucidate the phenomena of dentin hypersensitivity three chief mechanisms have been suggested: the Odontoblast receptor theory, the direct innervation theory and the Fluid movement/ hydrodynamic theory. The most widely accepted of these is fluid movement/hydrodynamic theory. According to this theory a variety of stimuli when applied to open dentinal tubules results in flow of dentinal tubular fluid which in turn stimulate baroreceptors and stimulate intratubular nerve endings and create pain.[2]

The key features in aetiology of DH are exposed dentinal tubules as a consequence of enamel loss due to tooth wear, trauma or exposed root surfaces associated with gingival recession. Tooth wear is linked with conditions such as abrasion, erosion, attrition and abfraction.[3] On the basis of numerous studies, DH develops in two phases; one is lesion localization & second is lesion initiation. In the 1st phase dentinal tubules become exposed due to loss of enamel and several etiological factors as cited above while in second phase for exposed dentinal tubule to be sensitized, the smear layer & tubular plug which cover the dentinal tubules temporarily and inconsistently are removed, causes dentinal tubular and ultimately pulpal exposure resulting in DH.[2]

Dentin hypersensitivity is frequently observed in younger patients with root surface exposure compared to older individuals with similar exposure. This could be due to dentinal sclerosis, decrease in number of dentinal tubules, reduction in pulp chamber size due to reparative dentin deposition and reduction in cellularity, vascularity & nerve fibers with age.[4]

The management of DH comprise of accurate diagnosis, preventive strategies, dietary guidance, appropriate treatment selection and patient monitoring. The treatment of DH is by either occluding dentinal tubules or to desensitize pulpal nerve fibers. There are a variety of in-office and over the counter (OTC) products available which are effective in decreasing dentin hypersensitivity.[5]

One of the in-office material is glass ionomer cement (GIC), a restorative material that is used for management of DH. GIC has the property of chemical adhesion and fluoride release and owing to these properties it seals dentinal tubules. However, GIC is relatively un-aesthetic and has inferior mechanical properties which may affect the long-term management of DH.[6]

Another material used for management of DH with promising results is dentin bonding agent (DBA). DBA eliminates smear layer, etches dentinal surfaces, forms resin tags inside dentinal tubules and creates a hybrid layer. These actions help prevent dentin hypersensitivity.[7]

Ideally the most effective treatments for DH are those that provide long-lasting effects, are not adversely affected by oral environmental challenges, and offer immediate relief to the patients. However, despite the wide range of available treatment options, no consensus has been reached on the best treatment plan.[8]

Many studies have been conducted elsewhere [9, 10] but no such study has been conducted in our setup. This clinical study aims to compare the effectiveness of GIC and DBA for treatment of DH to find a cost-effective and conservative treatment option with long-lasting effects. The results will assist practitioners in selecting a better treatment plan and provide patients with effective relief from hypersensitivity problems.

There is no significance difference in the efficacy of glass ionmer cement and dentin bonding agent in the management of dentin hypersensitivity in patients presenting to Peshawar Dental College

MATERIAL AND METHODS

This quasi-experimental clinical trial was conducted on patients presenting to Department of Operative Dentistry and Endodontics at Peshawar Dental College from February to August 2022, regardless of gender. The study protocol was approved by the Institutional Review Board of Prime Foundation (IRB/2022-401). An informed consent was taken from the study participants. A total of 60 patients in age range of 18–70 were selected based on convenience sampling. The sample size was determined by using Openepi online calculator with power of test (80%) and a 5% significance level resulting in calculating sample size of 60. The inclusion criteria were: vital teeth, no carious lesion or restoration, absence of congenital enamel or dentin anomalies and absence of calculus in the particular teeth. The exclusion criteria included history of periodontal surgery in last 3 months, use of desensitizing toothpastes and pregnancy. Patients with dentin hypersensitivity who met the inclusion criteria were examined clinically. The treatment procedure was thoroughly explained to the patients, and those who agreed to participate signed an informed consent form.

The teeth for which patients reported DH were exposed to tactile (hand-held scratch device), thermal (cold) and evaporative (dental unit air syringe) stimuli at baseline, immediately after the application, and at 3- and 6-weekspost treatment. The patients' responses to these stimuli were recorded using a visual analogue scale (VAS).

The baseline sensitivity levels were evaluated prior to treatment by means of a VAS. Patients were asked to place a mark on a scale ranging from 0 to 10. Where 0 indicated no pain and 10 indicated maximum. All the stimuli were applied on exposed root surfaces with the neighbouring teeth being isolated by cotton rolls and suction device.

After recording the baseline scores, patients were divided into two study groups. Group A received GIC while Group B received DBA as therapeutic agent. The co-investigator applied the test materials and the principal investigator assessed the sensitivity levels at all investigation times. The experimental agents were applied in accordance with manufacturers' directions.

Teeth in Group A were cleaned, isolated with cotton rolls and thinly mixed GIC was applied to the exposed root surfaces. In Group B, the teeth with hypersensitivity were isolated with cotton rolls, dried, acid etched for 20 seconds, washed and dried with a cotton pallet. The bonding agent was then applied, gently thinned with air syringe and light cured for 20 seconds. All teeth in both groups were evaluated immediately after application, and at 3 and 6 weeks post operatively. After the application of test materials all the subjects were given non-flouridated toothpaste and soft bristle brush. They were demonstrated and instructed with the roll-on technique for the duration of study.

The statistical analyses were performed using SPSS version 26.0. Means and standard deviations were calculated for quantitative variable, i.e., age. Frequencies and percentages were calculated for qualitative variables such as gender, degree of pain. Comparisons between the effects of two interventions on dentin hypersensitivity were performed through Chi square test. A *p*-value of 0.05 or less was considered significant.

RESULTS

A total of 60 patients were included in the study out of which 34(57%) were males and 26(43%) were females. The mean age of the participants were 42.4±12.2 years. Thirty Patients in group A were treated with glass ionomer cement &30 in Group B were treated with dentin bonding agent. Table 1and 2 demonstrate that in both groups the pain score decreased from severe to moderate to mild or no pain immediately after application compared to baseline (p=0.824 and 0.613) respectively. Table 3 shows that, at the 1-week follow-up, most patients in both groups reported mild or no pain (p=0.64). After 6 weeks of follow up, most of the patients in both groups experienced mild pain as shown in table 4 (p=0.338).

Table-1: Frequency distribution of pain scores by gender in both treatment groups

Baseline record			Groups of patients		Total	*p*-value
			Glass ionomer cement	Dentine bonding agent		
Mild pain	Gender of patients	male	5 (62.5%)	3 (37.5%)	8 (100%)	
		female	0 (0%)	1 (100%)	1 (100%)	
	Total		5 (55.5%)	4 (44.5%)	9 (100%)	
Moderate pain	Gender of patients	male	5 (38.5%)	8 (61.5%)	13 (100%)	
		female	8 (57%)	6 (43%)	14 (100%)	0.824
	Total		13 (48%)	14 (52%)	27 (100%)	
Severe pain	Gender of patients	male	6 (46%)	7 (54%)	13 (100%)	
		female	6 (54.5%)	5 (45.5%)	11 (100%)	
	Total		12 (50%)	12 (50%)	24 (100%)	
Total	Gender of patients	male	16 (47%)	18 (53%)	34 (100%)	
		female	14 (54%)	12 (46%)	26 (100%)	
	Total		30 (50%)	30 (50%)	60 (100%)	

Table-2: Frequency distribution of pain scores by gender in both treatment groups immediately after application

Immediately after application			Groups of patients		Total	*p*-value
			Glass ionomer cement	Dentine bonding agent		
No pain	Gender of patients	male	11(48%)	12 (52%)	23(100%)	
		female	9 (69%)	4 (31%)	13(100%)	
	Total		20 (55.6%)	16 (44.4%)	36(100%)	
Mild pain	Gender of patients	male	5 (50%)	5 (50%)	10(100%)	
		female	5 (34.5%)	8 (61.5%)	13(100%)	
	Total		10 (43.5%)	13 (56.5)	23(100%)	0.613
Moderate pain	Gender of patients	male		1 (100%)	1(100%)	
	Total			1 (100%)	1(100%)	
Total	Gender of patients	male	16 (47%)	18 (53%)	34(100%)	
		female	14 (54%)	12 (46%)	26(100%)	
	Total		30 (50%)	30 (50%)	60(100%)	

Table-3: Frequency distribution of pain scores by gender in both treatment groups one week after treatment

Follow up after 1 week			Groups of Patients		Total	*p*-value
			Glass ionomer cement	Dentine bonding agent		
No pain	Gender of patients	male	7 (41%)	10 (59%)	17 (100%)	
		female	9 (75%)	3 (25%)	12(100%)	
	Total		16 (55%)	13 (45%)	29(100%)	
Mild pain	Gender of patients	male	9 (56%)	7 (44%)	16(100%)	
		female	4 (33%)	8 (67%)	12(100%)	
	Total		13 (46%)	15 (54%)	28(100%)	0.64
Moderate pain	Gender of patients	male	0 (0%)	1 (100%)	1(100%)	0
		female	1(100%)	1(100%)	2 (100%)	
	Total		1 (33%)	2 (67%)	3 (100%)	
Total	Gender of patients	male	16 (47%)	18 (53%)	34 (100%)	
		female	14 (54%)	12 (64%)	26(100%)	
	Total		30 (50%)	30 (50%)	60 (100%)	

Table-4: Frequency distribution of pain scores by gender in both treatment groups six weeks after treatment

Follow up after 6 weeks			Groups of Patients		Total	*p*-value
			Glass ionomer cement	Dentine bonding agent		
No pain	Gender of patients	Male	6 (67%)	3 (33%)	9 (100%)	
		Female	4 (80%)	1 (20%)	5(100%)	
	Total		10 (71%)	4 (29%)	14(100%)	
Mild pain	Gender of patients	Male	6 (33%)	12 (67%)	18(100%)	
		Female	8 (53%)	7 (47%)	15(100%)	
	Total		14 (42%)	19 (58%)	33(100%)	
Moderate pain	Gender of patients	Male	4 (75%)	3 (43%)	7 (100%)	0.338
		Female	2 (33%)	4 (67%)	6(100%)	
	Total		6 (64%)	7 (36%)	13(100%)	
Total	Gender of patients	Male	16 (47%)	18 (53%)	34(100%)	
		Female	14 (54%)	12 (46%)	26(100%)	
	Total		30 (50%)	30 (50%)	60(100%)	

DISCUSSION

Dentin hypersensitivity is a common condition that patients present with, characterized by short and sharp pain as a result of various stimuli such as thermal, tactile and evaporative. Many factors are involved in its aetiology such as exposed root surfaces due to gingival recession or periodontal problems, tooth surface loss due to attrition, erosion, abfraction or trauma. A variety of treatment options are available to treat dentin hypersensitivity with the aim to resolve the problem either with the use of desensitizers to desensitize the nerve fibers or to occlude the exposed dentinal tubules. However no single option has been proven to completely and satisfactorily resolve the problem.

In our study 57% of patients were male and 43% were females indicating a higher prevalence of dentin hypersensitivity in males according to our findings.

The results of the study showed that by applying glass ionomer cement or dentin bonding agent, the pain decreases immediately from severe to mild or no pain as compared to baseline record. On follow-up after 1- & 6-weeks majority of patients experiences mild pain.

To date, a lot of studies were done to compare various treatment modalities for management of dentin hypersensitivity. For example a study by Masumeh Hasani Tabatabai et al[11], reduction in dentin hypersensitivity was observed immediately after treatment, as well as at 3 and 6 months post-application in all groups. On the other hand, another study performed by Marina de Matos Madruga*et* al[12], compared the long-term clinical outcomes of treatment for dentin hypersensitivity by comparing the resin modified glass ionomer cement (Clinpro XT) with conventional glass ionomer cement (Vidrion R). The results showed that both treatments effectively reduced pain symptoms immdetiely after application and maintain this effect over a 6 months follow-up. The results of both studies are in agreement with our study.

Another study conducted by Paul I Idon, Temitope A Esan, Corrnelius T Bamise[13]compared the efficiency of three in-office dental materials-Pro-Relief ,Copal F and placebo (distilled water) for treating hypersensitive teeth. The study showed that the mean difference in VAS scores between baseline and post treatment periods significantly increased for all the desensitizing agents except for placebo. However, with the application of Gluma desensitizer, a higher number of teeth were pain free at the 4 week interval. Therefore, it can be suggested as an appropriate desensitizing agent for in-office treatment of dentin hypersensitivity.

Yi-Jian Ding *et al*[14], performed a placebo-controlled study to evaluate the efficacy of several dental materials such as Clinpro XT varnish (VXT) and Gluma dentin desensitizer for treating DH. They randomly divided teeth into 3 groups: varnish (VXT), Gluma and placebo (warm water). DH was evaluated before treatment on a 0–10 VAS after applying tactile, thermal & evaporative stimuli. Evaluations were then conducted immediately after application, as well as at 1week and 4 weeks post-treatment. For all the stimuli, mean hypersensitivity was considerably decreased in VXT & Gluma groups at all-time points compared to baseline recordings. Among all groups, the VXT group had significantly lower mean VAS scores at all-time points, regardless of the type of stimuli. S Kumar et al[15], performed a study on iontophoresis and the topical application of 8% arginine- calcium carbonate to treat dentinal hypersensitivity. In this study, they treated 80 patients, 40 patients in each group receiving either 8% proarginine or iontophoresis. Patients were then recalled after 1, 2 & 4 weeks. Patients experienced substantial reduction in dentin hypersensitivity on VAS from 1st to 4th week. However the group treated with 8% arginine combined with iontophoresis showed a significant reduction in dentin hypersensitivity.

A study conducted by Srinivasan-Raj Samuel, Sachin G. Khatri and Shashidar[16] Acharya to evaluate the efficacy of self-applied versus professionally applied agents for relieving hypersensitivity. They carried out a randomized controlled trial among 57 patients. In this study, 8% Arginine paste was self-applied by the patients while Gluma desensitizer was applied by the investigator. The Numeric rating scale was used to measure hypersensitivity after tactile stimuli and Schiff scale was used for cold & air blast stimuli at baseline, immediately, and at 15 and 30 days after application. The results showed that 8% arginine significantly reduced hypersensitivity immediately and maintained its effect throughout the follow-up period, compared to Gluma. Both treatments showed a significant decrease in hypersensitivity from baseline to follow-up for all types of stimuli, however 8% arginine was found to be more effective than the professionally applied Gluma. Gowri Sivaramakrishnan & Kannan Sridharan[17] also compared different materials for managmemt of dentin hypersensitivity. They performed a randomized control trial with 38 patients, comparing fluoride varnish and gluteraldehyde. Hypersensitivity was recorded using VAS at baseline, 5 minutes after application, and 7 days

post application. The results showed that both agents reduces hypersensitivity on VAS without any superiority of one over the other. However, Gluma produced a noteworthy reduction in hypersensitivity at 7 days post-treatment compared to Duraphat (fluoride varnish).

NilamBrahmbhatt et al[18], performed a randomized, double blind, split-mouth study to compare three different treatment options for dentin hypersensitivity. They randomly divided 260 teeth from 25 patients into four groups. Group A was treated with 2% NaF, Group B with GLUMA®, Group C received ionotophoresis with distilled water (Placebo) and Group D with NaF ionotopherosis. Pain response was noted on VAS at baseline, 15 days, 1month, and 3 months.

Their results showed that all treatment options were effective in reducing hypersensitivity compared to the placebo group. However, Group B (Gluma) & D (NaF iontophoresis) were more effective at the 15 day & 1 month intervals. At the 3-month follow up, Group D, (NaFionotoperososis) was the most effective of all the treatments.

Shikhaverma et al[19], performed a subject-blind controlled trial to compare two different treatment modelities: an oxalate-containing desensitizer, BisBlock™ & a glutaraldehyde-containing desensitizer, Gluma® among 50 patients. The teeth were evaluated using VAS immediately after treatment, and then at 24hrs, one week, 1 month & 4 months. The results showed that both agents were able to reduce DH at all-time intervals. However, BisBlock™ group showed greater reduction in dentin hypersensitivity at 1 week and 1 month intervals. They concluded that compared to Gluma®, BisBlock™ was more effective in reducing dentin hypersensitivity.

The strengths of the study include assessing patients' sensitivity immediately after treatment, as well as at 1 week and 6-week follow-ups. This approach provided a more comprehensive view of the intervention's effectiveness over time. Additionally, the study used the Visual Analog Scale (VAS) to measure sensitivity, a method widely accepted in clinical research.

The limitations of the study include its conduct at a specific dental college, which may limit generalizability of the findings to other populations or settings. Additionally, a long term follow-up could have provided insights into the durability of the interventions.

CONCLUSION

Based on the findings of this study, it can be concluded that both glass ionomer cement & dentin bonding agents are effective for the immediate reduction of dentin hypersensitivity. No significant differences were observed at follow-up, as majority of patients reported mild pain in both groups. Further studies are needed to evaluate the long-term stability of these positive results.

Conflict of interest: None

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AUTHOR'S CONTRIBUTION

IA: Conception and design of study, drafting and writing the manuscript and responsible for integrity of research. HK: Data collection and analysis. AA: Data interpretation, proof reading.

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