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A comparative evaluation of light cured ormocer based desensitizer and shield force plus desensitizer in reducing dentin hypersensitivity- A clinical study

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Abstract

The aim of the study was to evaluate and compare the clinical efficacy and durability of light cured ormocer based desensitizer and Shield Force Plus desensitizer in reducing Dentin Hypersensitivity. In this randomized controlled clinical study, 12 systemically healthy patients were selected based on various inclusion and exclusion criteria. In total 120 teeth in these 12 patients were randomly allocated into three groups of 40 teeth each: Group A: Teeth treated with light cured ormocer based desensitizer (Admira Protect), Group B: Teeth treated with Shield Force Plus and Group C: Teeth treated with Sterile water (Placebo). Both Tactile test and Air Blast test were performed at baseline to evaluate the pain and scores were recorded using Visual analog scale (VAS). All the groups received applications of allotted materials on 1st, 7th, 14th, and 21st day. After each applications VAS score was recorded. On 30th and 60th day, only VAS scoring was done without the application of products to determine the durability of the

two products. The data thus recorded was compiled, tabulated and statistically analysed to arrive at the results. All the treatment groups showed statistically significant reduction in Dentin Hypersensitivity but on intergroup comparision Group A showed significantly more reduction in mean VAS scores at different time intervals in response to both Tactile test and Air Blast test than Group B. So, within the confines of the study, Admira Protect seems to be clinically more efficacious and durable than Shield Force Plus in management/ reduction of Dentin Hypersensitivity, but further long term studies should be carried out to affirm the results of the study.

Keywords: Admira Protect, Dentin Hypersensitivity, Shield Force Plus, VAS.

Introduction

Dentin Hypersensitivity is defined as "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".[1]. Females have been reported to have a higher incidence of hypersensitivity than males and the greatest incidence has been documented in the 20-40 years age group. The most frequently affected teeth are premolars (68.8%), followed by molars, canines and incisors.[2]

Essentially, exposure of the dentin results from two different processes, either removal of the enamel covering the crown of the tooth or denudation of the root surface by loss of cementum and overlying periodontal tissues. Removal of the enamel may result from attrition relating to occlusal abnormalities, toothbrush abrasion, dietary erosion, habits or a combination of these factors.[3]

Dentin Hypersensitivity is a condition wherein exposure of affected teeth to thermal, tactile and chemical stimuli gives rise to symptoms ranging from mild discomfort to prolonged, severe pain.[4] The pain arising from exposed dentin in response to chemical, thermal, tactile and osmotic stimulus varies in both frequency and severity. Thus, it may be rapid in onset, sharp in character and of short duration, lasting from seconds to minutes after the stimuli is removed or in some cases the pain may persist as a dull vague sensation in the affected tooth.[5][6]

Thus, the condition is perhaps more a symptom complex than a true disease and the severity of pain or the patient's interpretation of this condition appears to determine whether treatment is sought or not. The very subjective measure of pain arising from exposed dentin which may further be modified by psychological factors makes an accurate assessment of the extent of this problem difficult.[5][7]

The exact mechanism of transmission of pain response from the dentin to the terminal nerve endings is only hypothesized. Three theories have been proposed namely odontoblastic transduction theory, neural theory and hydrodynamic theory. The most widely accepted theory for transmission of pain is the hydrodynamic theory originally proposed by Gysi (1900) and scientifically explained by Brannstrom and Astrom (1972), who suggested that pain may result from the movement of the dentinal fluid in the tubules provoked by external stimuli such as temperature, physical or osmotic changes which, in turn, trigger nerve fibers within the pulp. Products for the management of Dentin Hypersensitivity typically aim to control the hydrodynamic mechanisms of pain.[8]

Hypersensitivity occurs as dentin is exposed to oral environment, but all vital teeth with exposed dentin are not sensitive as evidence indicates that for dentin to be sensitive, the dentinal tubules have to be patent at the surface.[9] Exposed root surfaces are not always sensitive to various stimuli which indicate an effective blockage

of dentinal tubules to transmission of impulses to the pulp.[10]Therefore, the ideal treatment of DH should be able to reduce fluid flow in the dentinal tubules or block pulpal nerve response or both.[1]

A growing range of products is available for the treatment of DH on the dental market. These products are generally separated into two categories: at-home and in-office treatments. Home treatments are first-step treatment approaches, and if in-home treatment fails to reduce pain or the pain becomes a more powerful irritant, in-office treatments are appropriate to treat DH.[11] Moreover, if the DH affects one or two teeth, in-office treatments could be indicated.[12]There is a wide range of in-office treatments for DH which includes dentin adhesives**,** resin emulsions**,** copal varnishes, glutaraldehyde-based adhesives, oxalates, fluorides, potassium nitrates, iontophoresis, cyanoacrylates and LASER therapies. These are more widely accepted as they provide instantaneous pain relief to the patients.[13]Despite the fact that there are a large number of products in the dental market for the treatment of Dentin Hypersensitivity, the continued release of new desensitizing agents suggests that no product has yet been proven to be completely successful.

Shield Force Plus is one such agent which is a self-etching light-cured dental adhesive. In an in vitro study, compared Shield Force Plus and Gluma desensitizer which demonstrated that Shield Force Plus had completely occluded tubules while Gluma desensitizer had partially occluded tubules. Hence, Shield Force Plus appeared more promising in occluding tubules than Gluma desensitizer.[14]Another recently developed synthetic desensitizing agent is light cured organically modified ceramic (ormocer) based desensitizer (Admira Protect). The desensitizing effects of Admira Protect occurs by precipitation of plasma proteins of dentinal fluid inside the tubules, thereby reducing fluid flow.[15] In an in vitro study, Admira group showed the lowest number of opened dentinal tubules when compared to artificial saliva, vivasens and neo active apatite suspension. Admira group occluded dentinal tubules well even after 1 week and 1 month of brushing.[2]

To the best of our knowledge, there is no study in the literature which compared the clinical efficacy of light cured ormocer based desensitizer with Shield Force Plus. Therefore, the purpose of the present study was the in-office evaluation and comparison of the clinical efficacy and durability of light cured ormocer based desensitizer and Shield Force Plus in reducing Dentin Hypersensitivity by using Visual Analog Scale.

Materials And Methods

Twelve systemically healthy patients (both male and female) were selected among those visiting the Department of Periodontology, Punjab Government Dental College and Hospital, Amritsar for this randomized controlled clinical study design based on the following criteria:

Inclusion Criteria

1. Systemically healthy patients in the age group of 20-40 years.
2. Patients with cervical lesions such as erosion, abrasion or gingival recession less than 4 mm.

Exclusion criteria

1. Patients with notable evidence of pulpitis, carious lesions, defective restorations, active periodontal disease, active cervical caries or deep abrasions involving pulp.
2. Pregnant and lactating women.
3. Patients with history of drug addiction, allergy/idiosyncratic reactions, use of analgesic and anti-inflammatory drugs.
4. Patients having denture bridge work.

5. Patients having fractured crown, root filled teeth and teeth with large restorations.

An approval was taken from the Institutional Ethical Committee and a written consent was obtained from all the participants before the examination. Patients qualified for the study who were willing to participate for 2 months were selected from the outpatients presenting to the outpatient department of the institution.A general assessment of demographic details, medical, and dental histories was obtained from the selected patients. The patients were labeled as 'Probables' and they were asked to undergo diagnostic cum evaluation tests. For final selection of the patients and to know the efficacy of products, two diagnostic cum evaluation tests were done.

Tactile test

The teeth were cleaned with polishing paste and a rotatory brush using a low speed handpiece. For diagnosis, the quadrants were isolated with cotton rolls and the dental surface dried with cotton pellets. It included placement of periodontal probe perpendicular to the tooth surface and passing by gentle pressure and gradually increasing until the patients responded spontaneously. The patients were then immediately asked to rate the pain using a Visual Analog Scale.

Air Blast test

Five minutes after the mechanical test the teeth were again isolated from the adjacent teeth mesially and distally using cotton rolls. A dental unit triple syringe at 40-65 psi was used to blow out air, which was kept perpendicular and 2 mm away from tooth surface while covering adjacent teeth with gloved fingers and cotton rolls to prevent false positive results. As the patients responded spontaneously after the test, they were asked to rate the pain using a Visual Analog Scale.

The determination of pain evaluation was carried out by Visual Analog Scale (VAS) which was given to the patients. The linear scale had grading from 0 to 10 where grade 0 indicated no pain and grade 10 indicated maximum pain. The patients were asked to mark at a point on the linear scale using a pen in accordance to the pain they tend to experience. If in doubt, a lesser score was assigned.

Patients with a minimum of one tooth with VAS score of ≥ 2 in three different quadrants were finally included in the study and each quadrant was randomly assigned to one of the three treatment groups. Soon after baseline screening, all the patients underwent thorough oral prophylaxis followed by treatment for Dentin Hypersensitivity. In total, 120 teeth in 12 patients were randomly allocated into three groups of 40 teeth each as follows:

Group A: Teeth were treated with light cured ormocer based desensitizer (Admira Protect).

Group B: Teeth were treated with Shield Force Plus.

Group C: Teeth were treated with sterile water (Placebo).

Procedure

1. Polishing with polishing paste and drying with cotton pellets was done on all the surfaces of the selected tooth and it was isolated using cotton rolls.
2. Application of Admira Protect for Group A patients was done by dispensing it on a microtim brush and was applied on the affected tooth. It was allowed to act for 20 seconds after which it was dispersed with a faint airjet and light cured for 10 seconds.
3. Topical application of Shield Force Plus for Group B patients was done on hypersensitive teeth using applicator brush and was left for about 10 seconds and then dried by dry air for 10 seconds and then light cured for 10 seconds.

4. The application of sterile water (Placebo) for Group C patients was done in the same manner.
5. Any residual material on the gingival surface was carefully removed making sure that none of the products touched the other zones of the oral mucosa.
6. Immediately after the treatment, both Tactile test and Air Blast test were again performed and 1st day scores were recorded using Visual Analog Scale.
7. For the desensitizing agent to get adequate time to act without being washed away, patients were instructed to avoid rinsing, eating, or drinking for 30 minutes after the treatment. In addition, patients were instructed not to use any other professional or self-applied desensitizing agent during investigation.

Patients were recalled at 7th, 14th, and 21st day for the application of the same agents. Both Tactile test and Air Blast test were performed at each visit after the application to evaluate the pain and scores were recorded using Visual Analog Scale.

Patients were reevaluated at 30th and 60th day. Both Tactile test and Air Blast test were performed and scores were recorded using Visual Analog Scale on these days without application of products to determine the durability of the two products.

Statistical analysis

The data thus recorded was compiled, tabulated and statistically analysed to arrive at the results.

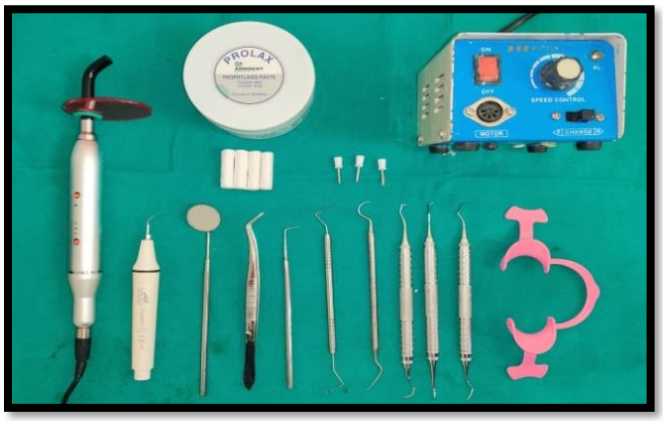


Figure 1: Armamentarium used in the study

Figure 2: Materials used in the study - Admira Protect, Shield Force Plus

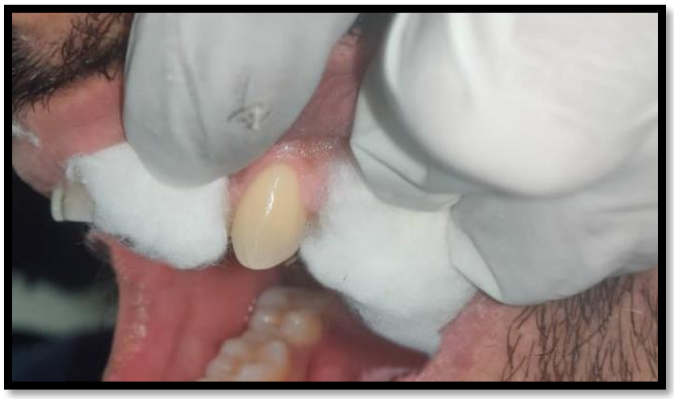


Figure 3: Isolation of the hypersensitive tooth

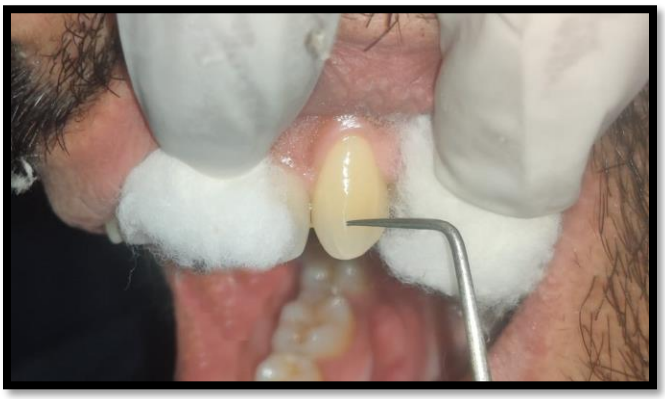


Figure 4: Performing the diagnostic cum evaluation test (Tactile test)

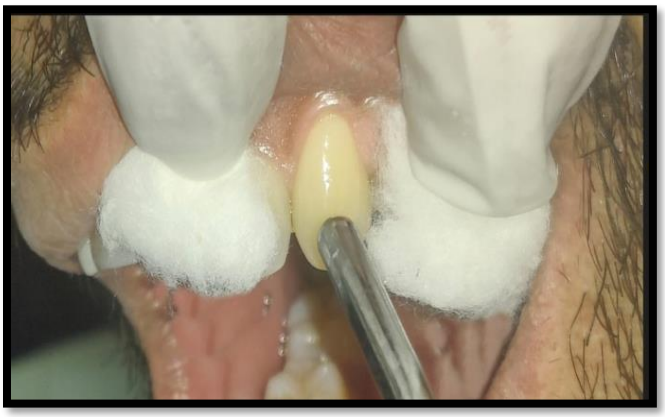


Figure 5: Performing the diagnostic cum evaluation test (Air Blast test)

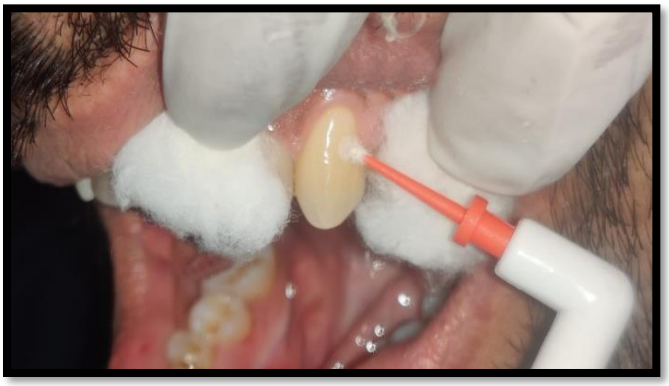


Figure 6: Application of Admira Protect in Group A

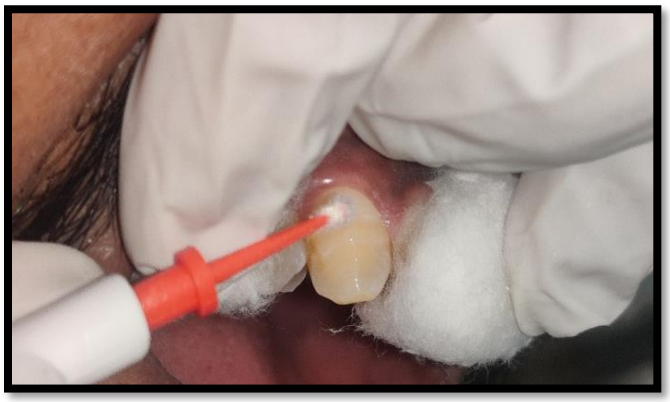


Figure 7: Application of Shield Force Plus in Group B

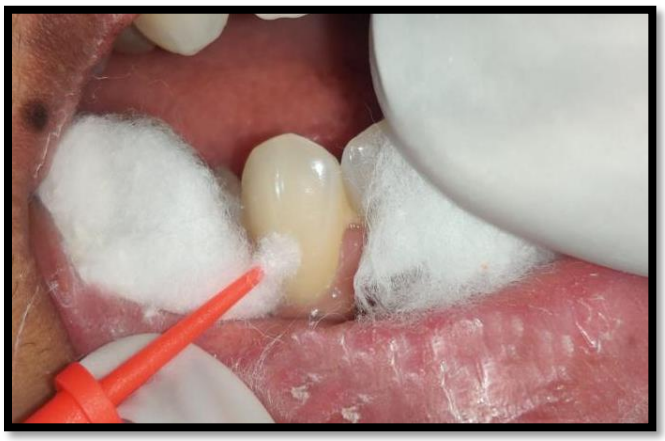


Figure 8: Application of Sterile water in Group C

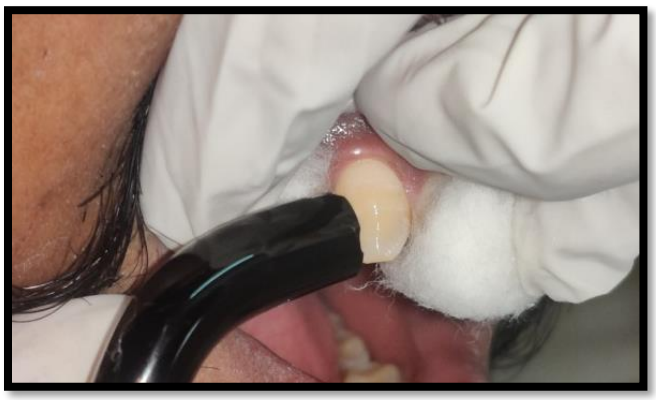


Figure 9: Showing desensitizer being cured on the experiment tooth

Results And Discussion

Table 1 and 2 shows the mean VAS scores for Group A, B and C at different time intervals in response to Tactile test and Air Blast test. Table 3 and 4 shows the intragroup comparison of mean VAS scores reduction at different time intervals for Group A, B & C in response

to Tactile test and Air Blast test. Table 5 and 6 shows intergroup comparative analysis of difference in mean VAS scores reduction at different time intervals for Group A, B & C in response to Tactile test and Air Blast test. Figure 1 and 2 shows graphical representation of mean reduction of VAS score of each group for each period which showed that Group A has given better result in reducing sensitivity as compared to Group B and Group C.

The occlusion of dentinal tubules is the major concern in the treatment of DH.[16,3] Different mechanisms have been proposed for occluding the dentinal tubules which can be done by the precipitation of proteins present in dentinal tubular fluid, precipitation of amorphous particles over exposed dentin surfaces and/or inside tubules, or by the formation of a superficial pellicle which may penetrate the dentin tubules[17] and the neural blocking method.[18]

Shield Force Plus is one such agent which is a self-etching light-cured dental adhesive. It is based on self-reinforcing technology that penetrates into the tooth substrate, have multi-point interactions with apatite calcium and three-dimensional cross-linking reactions. In an in vitro study, Shield Force Plus has shown completely occluded tubules than other desensitizer.[14] On the other hand, SEM studies have found that chemical agents such as light cure activated ormocer-based desensitizing agent (Admira protect) are effective enough to seal the dentinal tubules. The conventional light cure is used in polymerization of the resin thus reducing the fluid flow.[2,19]

To the best of our knowledge, there is no evidence in the studies which compared the clinical efficacy of light cured ormocer based desensitizer with Shield Force Plus. Hence, in this study, we evaluated clinical efficacy of Admira Protect (Group A) and Shield Force Plus (Group B), and a comparison was made with sterile water (Group C, placebo).

The two most common stimuli used in clinical studies are thermal and tactile stimuli.[20] In the present study, we tested with the help of tactile stimuli and air blast from a three in one air/water syringe, which was according to the study done by Sowinski et al. [21] The potency of the desensitizing agents was evaluated with VAS.

The significant reduction in mean VAS scores indicates that Admira Protect was efficacious in reducing Dentin Hypersensitivity in response to both Tactile test and Air Blast test. Also its desensitizing effect was maintained during the 60 days evaluation period indicating the durability of the material. Similar results were recorded by Ravishankar et al. (2018) who found that Admira Protect showed significant reduction in DH immediately after application, at 1 week, and 1 month compared to baseline mean VAS scores for both tactile and evaporative stimuli.[22] Similarly, Torres et al. (2014) in their study reported a significant reduction in mean VAS score for both tactile and evaporative stimuli after the application of Admira Protect when compared to Colgate Sensitive Pro-Releif and its desensitizing effect was maintained during the four-week evaluation. This longer-lasting effect may be related to the product's components like the resinous monomers that are able to adhere to dentin, forming a hybrid layer. In addition, Admira Protect contains fillers, which may promote higher resistance to abrasion, avoiding the removal of the product layer by tooth brushing.[23] Maity, Priyadarshini and Basavaraju (2020) compared the clinical efficacy and durability of Propolis and Admira Protect and found both were effective in reducing DH but Admira Protect was found to be more efficient in reducing pain with longer duration of action.[15]

The significant reduction in mean VAS scores indicates that Shield Force Plus was efficacious in reducing Dentin Hypersensitivity in response to both Tactile test and Air Blast test. Also its desensitizing effect was maintained during the 60 days evaluation period indicating the durability of the material. These findings are in coherence with the studies done by Gazhva et al. (2018), Eyuboglu and Naiboglu (2020) and Sayed et al. (2022) which also reported a significant reduction in Dentin Hypersensitivity as compared to the baseline after the use of Shield Force Plus.[24,25,26]

The significant reduction in mean VAS score indicates that Placebo has shown positive results. The similar positive placebo effect has also been reported in previous hypersensitivity studies by Pearce NX et al. (1994), Yates RJ et al. (2004) and West NX et al. (2013). Price et al. (2008) defined the placebo effect as a sham or simulated medical intervention that improves a given outcome, such as pain relief.[27,28,29,30]According to Wager et al. (2011) placebo treatments do not act with direct pharmacological or physical effects, but they usually engage in brain circuits that can confer therapeutic benefits.[31] Neurobiological factors underlying placebo-induced analgesia have been reported by Nolan et al. (2012).[32]

Thus both Group A (Admira Protect) and Group B (Shield Force Plus) showed significantly more reduction in Dentin Hypersensitivity when compared to Group C (Placebo). Among Group A and B, Group A showed significantly more reduction in mean VAS scores at different time intervals in response to both Tactile test and Air Blast test.

During the course of this study no side effects or adverse reactions were observed among the patients to any of the materials used.

The study however possesses few drawbacks. The study is of short duration with just 2 months which showed a significant reduction in sensitivity in all the groups. Furthermore, we have recorded mean scoring of two pain stimuli together, thereby allowing future studies to be planned by separately analyzing the evaporative and tactile stimuli. It would be very much interesting to note the major differences between the products used since all the products gave positive result in reducing dentin hypersensitivity.

Table 1: Mean VAS scores for Group A, B and C at different time intervals in response to Tactile test

Group	Time intervals													
	Baseline		1st day		7th day		14th day		21st day		30th day		60th day	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Group A	6.88	±1.98	4.63	±1.94	3.53	±1.58	2.53	±1.57	1.63	±1.15	0.98	±0.89	0.68	±0.76
Group B	6.13	±2.26	4.53	±1.96	3.63	±1.35	2.90	±1.69	2.28	±1.50	1.80	±1.20	1.48	±1.32
Group C	3.70	±1.38	2.60	±1.24	3.15	±1.55	3.15	±1.56	3.03	±1.70	3.25	±1.66	3.38	±1.46

Table 2: Mean VAS scores for Group A, B & C at different time intervals in response to Air Blast test

Group	Time intervals													
	Baseline		1st day		7th day		14th day		21st day		30th day		60th day	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Group A	6.98	±2.07	3.33	±1.40	3.45	±1.83	2.50	±1.55	1.78	±1.49	1.15	±1.42	0.88	±1.09
Group B	6.18	±2.47	4.28	±1.72	3.85	±1.90	2.95	±1.77	2.03	±1.46	1.73	±1.65	1.50	±1.47
Group C	4.05	±1.81	3.15	±1.78	3.30	±1.83	3.55	±1.45	3.53	±1.68	3.45	±1.77	3.65	±1.67

Table 3: Intragroup comparison of mean VAS scores reduction at different time intervals for Group A, B & C in response to Tactile test

Group	Time intervals	Mean	±SD	Mean Difference	±SD	Percentage	paired t-test	p-value	Significance
Group A	Baseline	6.88	1.98	2.25	0.90	32.73	15.834	<0.001	HS
	1st day	4.63	1.94						
	Baseline	6.88	1.98	3.35	1.37	48.65	15.476	<0.001	HS
	7th day	3.53	1.58						
	Baseline	6.88	1.98	4.35	1.61	63.27	17.08	<0.001	HS
	14th day	2.53	1.57						
	Baseline	6.88	1.98	5.25	1.63	76.29	20.382	<0.001	HS
	21st day	1.63	1.15						
	Baseline	6.88	1.98	5.90	1.82	85.82	20.47	<0.001	HS
	30th day	0.98	0.89						
	Baseline	6.88	1.98	6.20	1.77	90.18	22.134	<0.001	HS
	60th day	0.68	0.76						
Group B	Baseline	6.13	2.26	1.60	1.03	26.12	9.798	<0.001	HS
	1st day	4.53	1.96						
	Baseline	6.13	2.26	2.50	1.43	40.73	11.04	<0.001	HS
	7th Day	3.63	1.35						
	Baseline	6.13	2.26	3.23	1.29	52.65	15.80	<0.001	HS
	14th Day	2.90	1.69						
	Baseline	6.13	2.26	3.85	1.41	62.78	17.318	<0.001	HS
	21st day	2.28	1.50						
	Baseline	6.13	2.26	4.33	1.72	70.61	15.945	<0.001	HS
	30th day	1.80	1.20						
	Baseline	6.13	2.26	4.65	1.75	75.92	16.829	<0.001	HS
	60th day	1.48	1.32						
Group C	Baseline	3.70	1.38	1.10	0.81	29.73	8.587	<0.001	HS
	1st day	2.60	1.24						
	Baseline	3.70	1.38	0.55	0.68	14.86	3.439	0.002	HS
	7th day	3.15	1.55						
	Baseline	3.70	1.38	0.55	0.75	14.86	4.642	<0.001	HS
	14th day	3.15	1.56						

	Baseline	3.70	1.38	0.67	0.97	18.11	4.396	<0.001	HS
	21st day	3.03	1.70						
	Baseline	3.70	1.38	0.45	1.04	12.16	2.746	0.009	HS
	30th day	3.25	1.66						
	Baseline	3.70	1.38	0.33	0.80	8.78	2.579	0.014	S
	60th day	3.38	1.46						

Table 5: Intergroup comparative analysis of difference in mean VAS scores reduction at different time intervals for Group A, B & C in response to Tactile test

Time Intervals	Groups	Mean	±SD	Difference	Percentage	Un-paired t-test	p-value	Signficance
Baseline & 1st day	Group A	2.25	0.90	0.65±1.27	28.89	3.003	0.004	HS
	Group B	1.60	1.03					
	Group A	2.25	0.90	1.15±1.19	51.11	6.011	<0.001	HS
	Group C	1.10	0.81					
	Group B	1.60	1.03	0.50±1.34	31.25	2.409	0.018	S
	Group C	1.10	0.81					
Baseline & 7th day	Group A	3.35	5.25	-1.90±1.21	-56.7	2.713	0.008	S
	Group B	2.50	1.43					
	Group A	3.35	5.25	3.30±1.32	85.71	10.404	<0.001	HS
	Group C	0.55	1.01					
	Group B	2.50	1.43	0.13±1.22	18.5	7.034	<0.001	HS
	Group C	0.55	1.01					
Baseline & 14th day	Group A	4.35	1.61	1.13±1.45	5.86	3.448	0.001	HS
	Group B	3.3	1.9					
	Group A	4.35	1.61	3.80±1.88	87.36	13.533	<0.001	HS
	Group C	0.55	0.75					
	Group B	3.3	1.9	2.68±1.86	82.95	11.335	<0.001	HS
	Group C	0.55	0.75					
Baseline & 21stday	Group A	5.25	1.63	1.40±1.88	26.67	4.115	0.001	HS
	Group B	3.85	1.41					
	Group A	5.25	1.63	4.58±1.80	87.14	15.257	<0.001	HS
	Group C	0.68	0.97					
	Group B	3.85	1.41	3.18±1.29	82.47	11.751	<0.001	HS
	Group C	0.68	0.97					
Baseline & 30th day	Group A	5.90	1.82	1.58±2.35	26.69	3.979	<0.001	HS
	Group B	4.33	1.72					
	Group A	5.90	1.82	5.45±2.12	92.37	16.437	<0.001	HS
	Group C	0.45	1.04					
	Group B	4.33	1.72	3.88±1.98	89.60	12.227	<0.001	HS
	Group C	0.45	1.04					
Baseline & 60th day	Group A	6.20	1.77	1.55±2.39	25.00	3.939	<0.001	HS
	Group B	4.65	1.75					
	Group A	6.20	1.77	5.88±1.91	94.76	19.127	<0.001	HS

	Group C	0.33	0.80					
	Group B	4.65	1.75	4.33±1.83	93.01	14.242	<0.001	HS
	Group C	0.33	0.80					
	Group C	0.13	0.69					

Figure 1

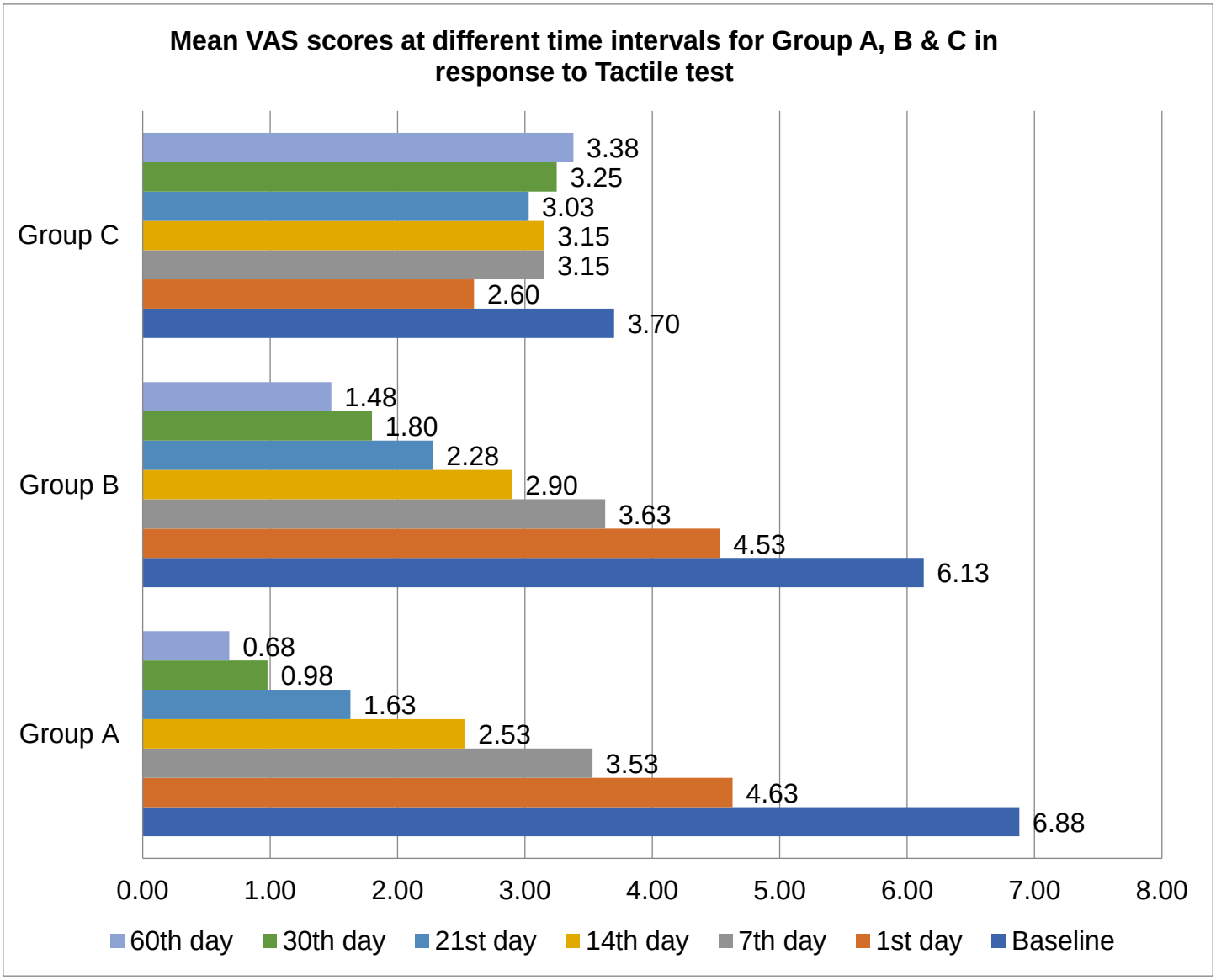
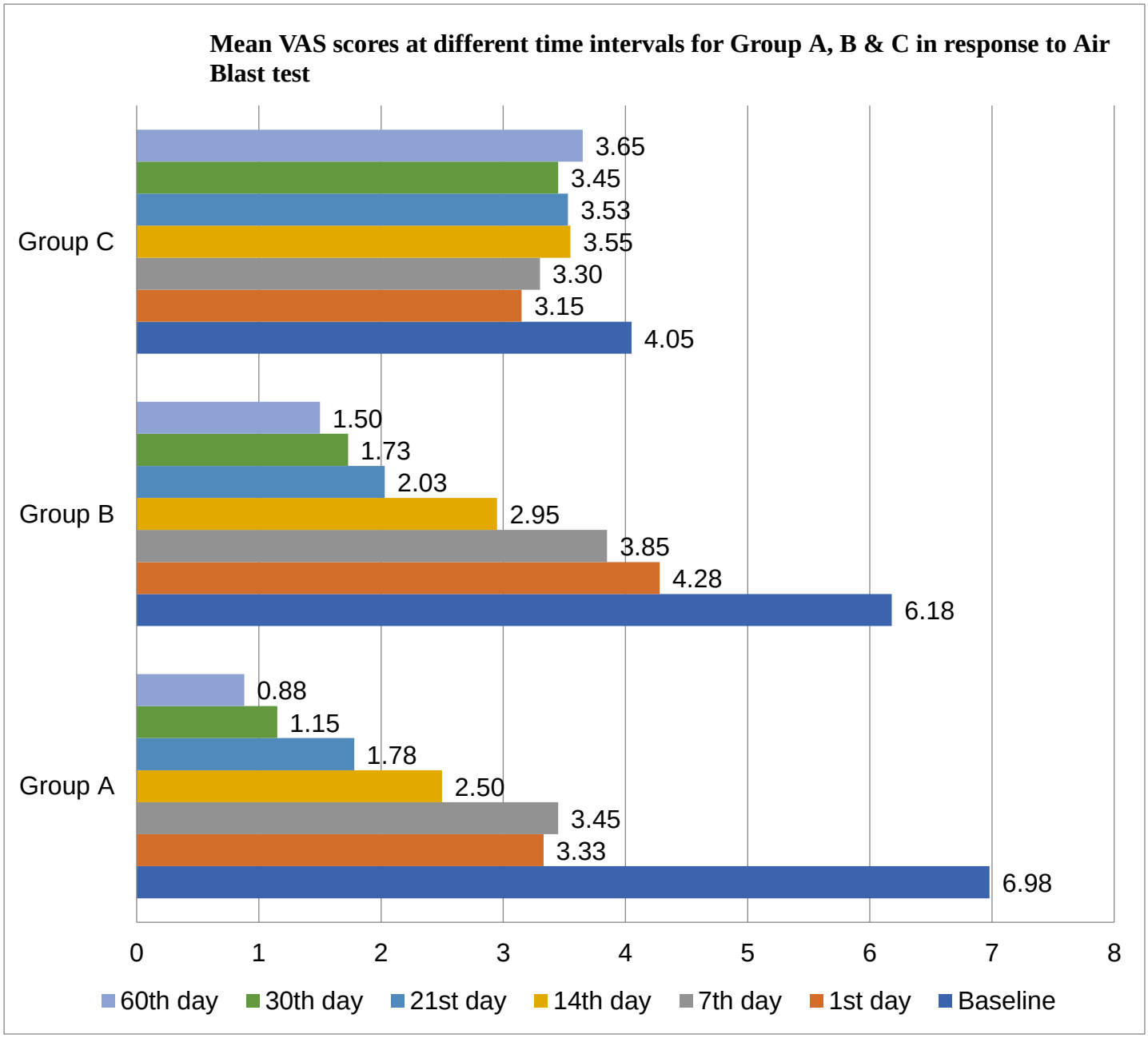


Figure 2



Conclusion

Hence, it may be concluded that both Admira Protect and Shield Force Plus demonstrated significant reduction in Dentin Hypersensitivity at different time intervals in response to Tactile test and Air Blast test, with Admira Protect showing significantly better results. The durability of both Admira Protect and Shield Force Plus is long-lasting as their desensitizing effect was maintained during the 60 days evaluation period. So, within the confines of this study, Admira Protect seems to be clinically more efficacious and durable than Shield Force Plus in management/ reduction of Dentin Hypersensitivity, but the short follow up time period and relatively small sample size of the present study may be the limiting factor for the power of the statistical analysis. A further large and long term randomized

controlled clinical trials should be carried out to affirm the results of the study.

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