ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Evaluation Of Tensile Bond Strength Of Glass Fiber Posts And Custom Made Zirconium Dioxide Posts Fabricated By CAD-CAM Technology Cemented With Two Different Resin Cements-An Invitro Study.

Malathi Dayalan[1], Navdeep Gill[2], Ravindra Savadi[3], and Abhishek Taneja[4]*.

[1] HOD & Proffessor, The Oxford Dental College & Hospital, Bangalore.
[2] MDS Prosthodontics
[3] MDS Prosthodontics
[4]PG Student, Department Of Prosthodontics, The Oxford Dental College & Hospital, Bangalore.

ABSTRACT

The purpose of this study was to compare the tensile bond strength of prefabricated glass fiber posts and custom made zirconium di-oxide posts fabricated with CAD CAM technology cemented with two commercially available dual cure self-adhesive resin cements. The study was carried out using 20 samples of prefabricated glass fiber posts and 20 samples of CAD-CAM fabricated zirconium di-oxide posts. In each of the post group, 10 samples were cemented with RelyX U100 cement and the remaining half with SmartCem2 cement. The post-tooth complex was embedded in a poly vinyl chloride cylinder using a surveyor. The specimens were tested for tensile bond strength by applying tensile load at a cross head speed of 0.5mm per minute. Higher mean tensile bond strength values were recorded for glass fiber posts compared to zirconium di-oxide posts and the difference in mean tensile bond strength was found to be statistically significant. Within the limitations of this study, higher bond strength values were obtained with prefabricated glass fiber posts as compared to zirconium di-oxide posts. No significant difference was observed between two cements (Rely X U100 and Smart cem 2 cement) with respect to tensile bond strength of Glass fiber posts and Zirconium di-oxide posts.

Keywords: Tensile bond strength, glass fiber posts, zirconium di-oxide posts, computer aided design/ computer aided manufacturing (CAD-CAM), dual cure self-adhesive resin cement

***Corresponding author**

ISSN: 0975-8585

INTRODUCTION

Prosthodontic procedures required for the fabrication of fixed partial denture on vital tooth have the potential to induce post-operative discomfort, dentinal hypersensitivity and subsequent pulpal irritation. Post cementation sensitivity rates have varied widely in clinical studies ranging from a low of 3% to a high of 34%.[1,2] Since the introduction of glass ionomer material as a luting medium for fixed restoration there has been considerable speculation regarding potential post cementation sensitivity [3,4]. Number of possible causes that can develop abutment tooth sensitivity following tooth preparation and cementation have been suggested including aggressive tooth preparation, poor provisional restorations, bacterial leakage and contamination, dessication of the preparation prior to cementation[5], removal of the protective smear layer and invivo dissolution of the luting agents at the margin of restorations.[6] To reduce the risk of vital abutment sensitivity an alternative approach proposed is the concept of sealing exposed dentine with desensitizing agents following tooth preparation and before cementation of restoration.[7,8] Clinical efficacy of desensitizing agents in reducing the dentine sensitivity has been reported when applied on teeth prepared to receive complete cast restoration.[9-11] There is insufficient data at present with regard to the clinical efficacy of desensitizing agents to reduce the post cementation sensitivity of glass ionomer cement, hence this clinical investigation was designed.

MATERIAL AND METHODOLOGY

The present study was conducted in the Department of Prosthodontics including Crown and Bridge and Implantology at College of Dental Sciences, Davangere.

The patients were accepted for the study on the basis of the following inclusion criteria.[9]

Inclusion criteria:

- Individuals in generally good health.
- Each patient had minimum of two teeth in need of complete coverage crown utilized as abutment teeth (missing 1st molar, unilateral or bilateral).
- Teeth to be investigated displayed a vital pulp, confirmed by sensitivity response to electric pulp test.
- Teeth radiographically demonstrated normal apical periodontal ligament space.
- Previous restorations if present involve less than 50% of the coronal tooth surface.
- Teeth had no previous history of hypersensitivity to thermal or other irritation.

ISSN: 0975-8585

Materials used in the study:

1) Bisblock dentine desensitizer (Bisco Inc. Schaumburg, U.S.A.)
2) Systemp desensitizer (Ivoclar vivadent AG, Schaan Liechtenstein)
3) GC tooth mousse desensitizer (GC-Asia dental Pte. Ltd., Singapore)
4) Polyvinyl siloxane putty impression material (Express^{TM} STD, 3M ESPE)
5) Polyvinyl siloxane light body and heavy body material (Express^{TM}, 3M ESPE)
6) Protemp^{TM} (3M ESPE, Germany)
7) Temp Bond (Rely X^{TM} Temp^{NE}, 3M ESPE, Germany)
8) Ultrapack (# 1, # 0) displacement cord, Ferric sulfate + Astringent (Astringedent, ultradent products, USA)
9) Glass ionomer luting cement GC Fuji I (GC Corp, Japan)
10) Distilled cold water (10^{o}C)

Thirty patients requiring 3 unit fixed partial denture or full coverage restorations on the maxillary or mandibular posterior teeth were selected for the study. The study was design to have a total of forty restorations (n=40). Prepared abutment were randomly assigned into 4 groups comprising 10 restoration in each group (n=10) [figure 1].

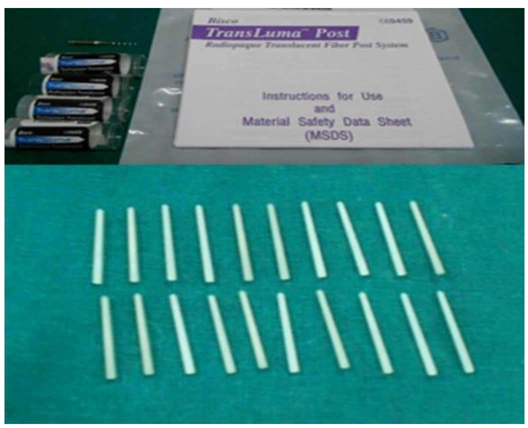


Table: 1 Amount of force applied and stress of dislodgement of group A samples

Sample number	Amount of force applied in Newton (N)		Stress of dislodgement in Megapascal (MPa)	
	Group A1 RelyX U100 cement	Group A2 SmartCem 2 cement	Group A RelyX U100 cement 1	Group A2 SmartCem 2 cement
1	106.5	119.6	1.98	2.22
2	116.9	113.4	2.17	2.11
3	99.19	144.3	1.84	2.68
4	115.2	130.9	2.14	2.43
5	128	135.2	2.38	2.51
6	120.9	113.4	2.25	2.11
7	109.7	133.4	2.22	2.48
8	114	142.7	2.12	2.65
9	104.4	105.3	1.94	1.96
10	119.8	107.8	2.23	2.00

1) Group C: Control – No desensitizer application was done
2) Group BB: Bisblock dentine desensitizer was applied.
3) Group ST: Systemp desensitizer was applied.
4) Group GC: GC Tooth mousse desensitizer was applied.
5) Components of each desensitizing agents are presented in Table 1.
6) In desensitizer groups respective desensitizer application was done following the manufacture directions immediately after tooth preparation before final impressions were made.
7) Single blind study was designed where patients were blinded to whether they were in one of the desensitizer group or control group. The same operator performed all treatments and evaluation for the study.

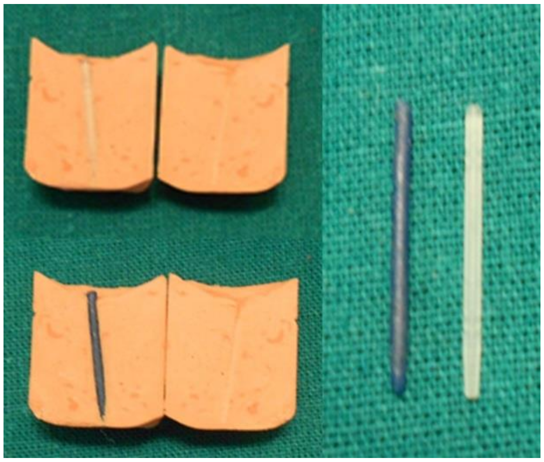
Method employed:

I. Clinical Procedures

Tooth preparation procedure: Teeth were prepared for complete coverage restorations according to standard prosthodontic principles using high speed handpiece, diamond instruments and copious water-coolant spray to minimize frictional heat and damage to the pulpal tissue.

Temporization procedure:

Provisional restorations were made using Protemp TM II (3M ESPE, Germany), by direct method using polyvinyl siloxane putty matrix. After this, application of respective dentine desensitizer was done on prepared abutment teeth. After making the final impression, fabricated provisional restorations were cemented with noneugenol provisional cement Tempbond NE (Rely X^{TM} Temp^{NE}, 3M ESPE, Germany) [figure 2].



Final Cementation of restoration:

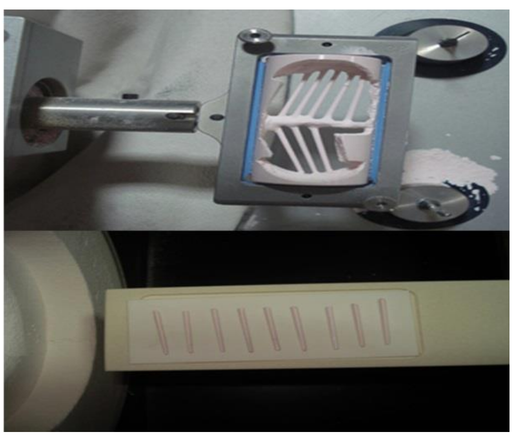
After one week, cementation of final restoration was done with Glass Ionomer luting cement (GC Fuji-1, GC Corporation, Japan) mixed in accordance with the manufacturer's instructions. Excess cement was removed from the margins of the restoration.

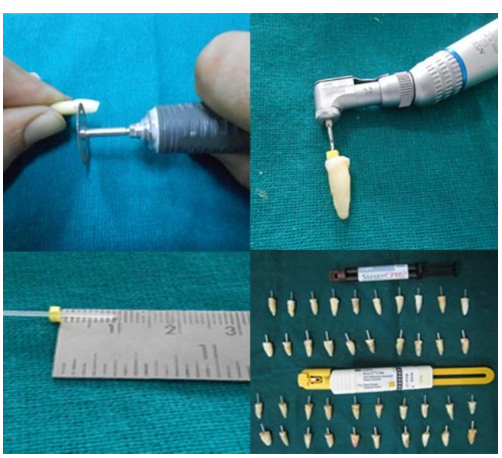
II. Patient evaluation procedures

1) Evaluation of Pre cementation sensitivity level: One week after desensitizer application, evaluation of pre-cementation sensitivity level of the prepared teeth which was considered as baseline sensitivity level was done by removing the provisional restorations.

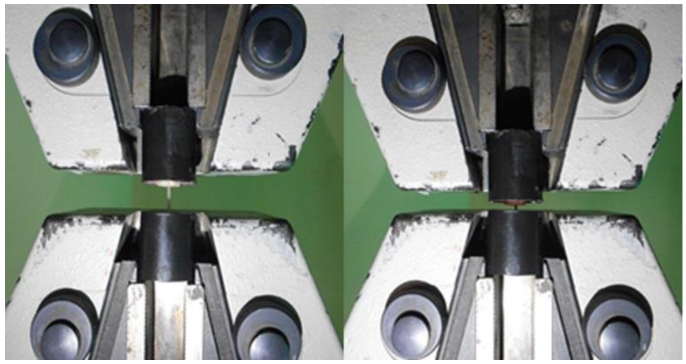
Procedure for evaluation:

Subjective evaluation of pain produced by cold stimulus was done for checking precementation sensitivity. Polyvinyl siloxane putty matrix with an circular occlusal opening was used as a stent to provide a small reservoir surrounding the test tooth and cold water was injected through the same opening; 1ml of cold water (10^0C) per second was injected through a disposable plastic syringe with 22 gauge needle (0.5 diameter). [Figure 3]




ISSN: 0975-8585



Each patient's report of tooth sensitivity was scored on visual analogue scale (VAS). The VAS consisted of a 10 mm line where zero is equivalent to "no pain" and 10 equivalent to "severe pain" or "worst imaginable pain". These values were transformed to number from 0 (non sensitive) to 10 (extremely hypersensitive).[12]

2) Evaluation of Post cementation sensitivity level: The patient's response to sensitivity was evaluated immediately after 5 minutes post cementation, one day post cementation, one week post cementation at routine recall visits. All individual patient data forms and a summary spreadsheet of the results were thoroughly examined and data was statistically analyzed.

RESULTS

One-way ANOVA was used for multiple group comparison followed by Post hoc Tukey's test for pairwise comparison. P value of 0.05 or less was considered for statistical significance. Bis block and GC tooth mousse desensitizer resulted in statistically significant ($p < 0.01$) reduction in post cementation sensitivity of glass ionomer cement in comparison to Systemp desensitizer at 5 minute, 1 week post cementation time interval with no statistical difference was seen between all desensitizer groups at 1 day post cementation. Application of Bisblock and GC tooth mousse desensitizer resulted in highly significant ($p < 0.01$) [Table 2] reduction in sensitivity level at the end of 1 week.

Table: 2 Amount of force applied and stress of dislodgement of group B samples

Sample number	Amount of force applied in Newton (N)		Stress of dislodgement in Megapascal (MPa)	
	Group B1	Group B2	Group B1	Group B2
1	85.8	104	1.59	1.93
2	69.59	84.52	1.29	1.57
3	72.51	85.6	1.35	1.59
4	100	98.05	1.86	1.82
5	98	98.64	1.82	1.83
6	84.44	92.35	1.57	1.72
7	101.5	103.9	1.89	1.93
8	100.4	101.6	1.87	1.89
9	104.6	105.3	1.94	1.96
10	106	107.8	1.97	2.0

Formula for calculating tensile bond strength (MPa) = Force(N)/ surface area(A) (mm^2)

ISSN: 0975-8585

$A = \pi \times g \times (R1+R2)$

A ~ surface area

π ~ constant = 3.14

g ~ slant height = 9mm

R1 ~ diameter of post at apex = 0.9mm

R2 ~ diameter of post at length of 9mm = 1mm

Table: 3 Mean and SD of tensile bond strength in two posts and two cements

Posts with cements	n	Mean	SD
Group A1	10	2.13	0.16
Group A2	10	2.32	0.27
Group B1	10	1.72	0.25
Group B2	10	1.82	0.15

Table: 4 Comparison of two posts (Glass fiber and Zirconium di-oxide) and two cements (RelyX U100 and SmartCem 2) with respect to tensile bond strength by 2 way ANOVA test

SV	Degrees of freedom	Sum of squares	Mean sum of squares	F-value	p-value
Main effects					
Posts	1	2.0385	2.0385	44.7221	0.0000*
Cements	1	0.2205	0.2205	4.8379	0.0343
2-way interaction effects					
Posts x Cements	1	0.0156	0.0156	0.3423	0.5622
Error	36	1.6409	0.0456		
Total	39	3.9156			

*p<0.05

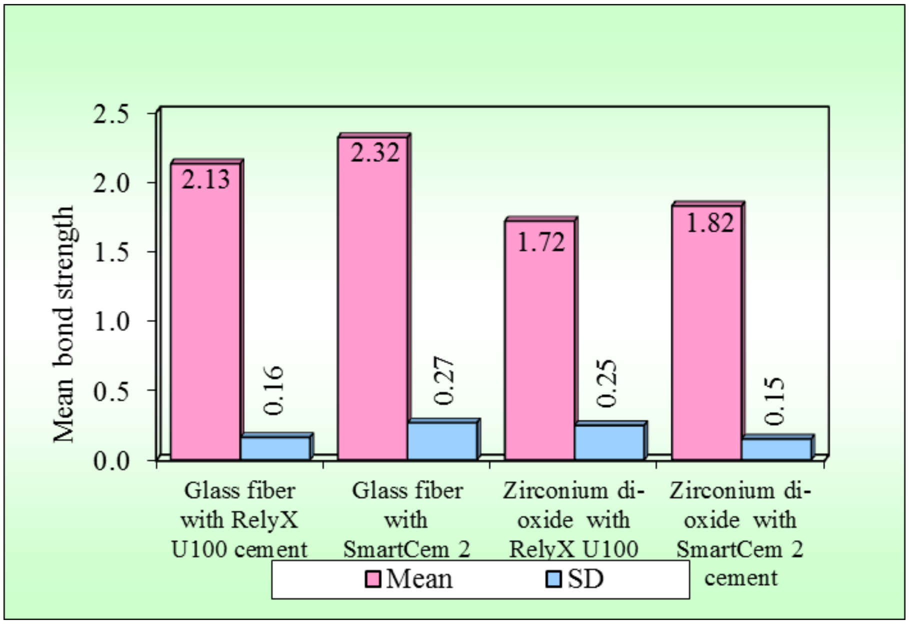
Table: 6 Comparison of two posts (Glass fiber and Zirconium di-oxide posts) in RelyX U100 and SmartCem 2 cement with respect to tensile bond strength by t test.

Cements	Posts	n	Mean	SD	t-value	P-value
RelyX U100	Glass fiber	10	2.1270	0.1631	4.3912	0.0004*
	Zirconium di-oxide	10	1.7150	0.2478		
SmartCem 2	Glass fiber	10	2.3150	0.2671	5.0562	0.0001
	Zirconium di-oxide	10	1.8240	0.1515		

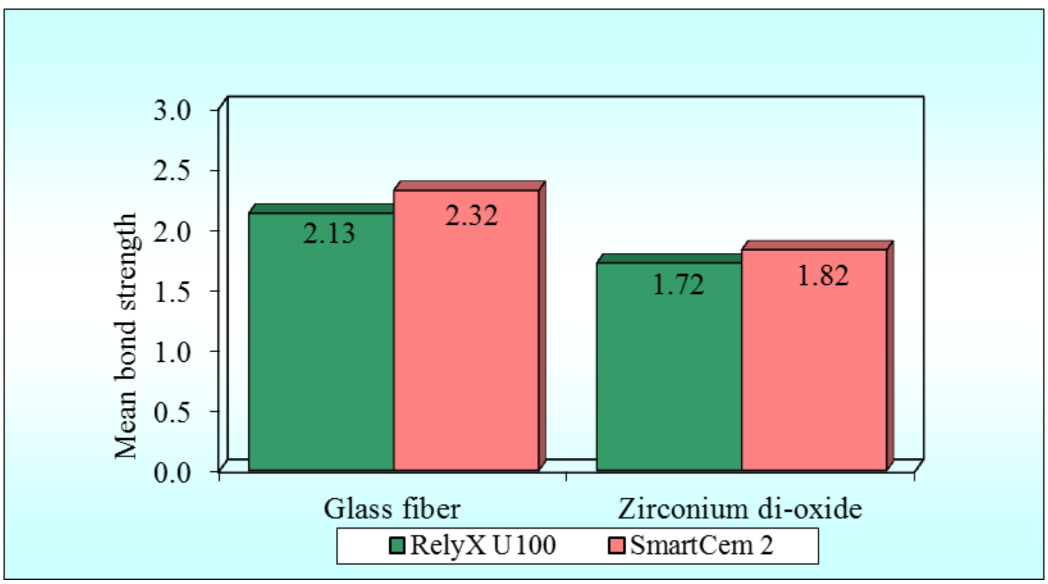
*p<0.05

Table: 7 Comparison of two cements (RelyX U100 and SmartCem 2 cement) in Glass fiber and Zirconium di-oxide posts with respect to tensile bond strength by t test.

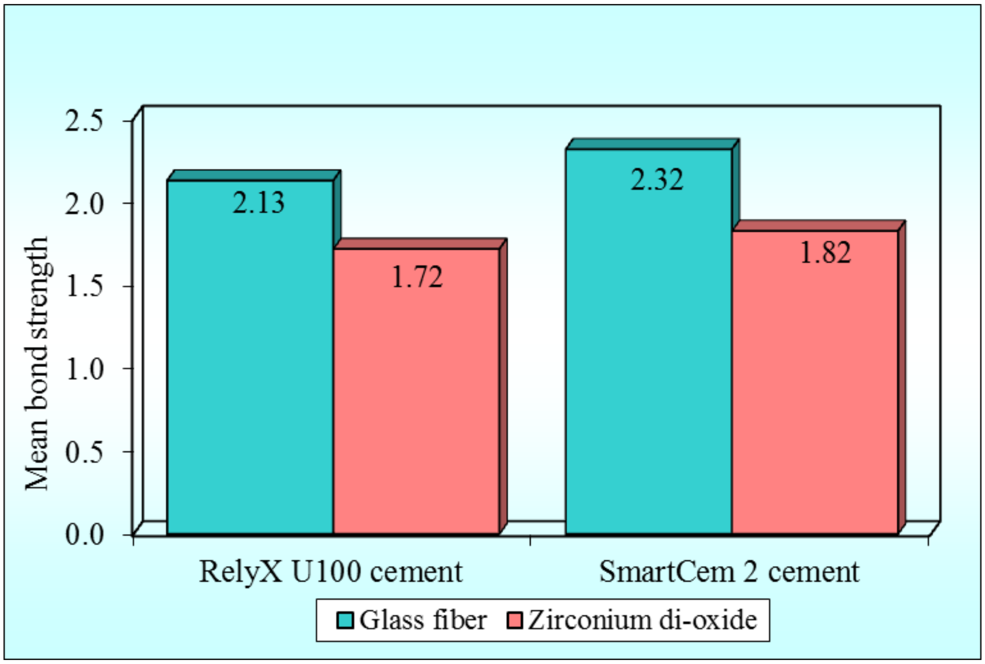
Posts	Cements	N	Mean	SD	t-value	P-value
Glass fiber posts	RelyX U100	10	2.1270	0.1631	-1.8995	0.0734
	SmartCem 2	10	2.3150	0.2671		
Zirconium di-oxide posts	RelyX U100	10	1.7150	0.2478	-1.1867	0.2508



Graph 1:Comparison of two posts (Glass fiber and Zirconium di-oxide) and two cements (RelyX U100 and SmartCem 2) with respect to tensile bond strength



Graph2: Comparison of two posts (Glass fiber and Zirconium di-oxide) in RelyX U100 and SmartCem 2 cement with respect to tensile bond strength



Graph3: Comparison of two cements (RelyX U100 and SmartCem 2 cement) in Glass fiber and Zirconium di-oxide posts with respect to tensile bond strength

No statistically significant difference was seen between the control and system desensitizer in reducing the post cementation sensitivity level at various time intervals. (Table 2, Graph I). This observation was different from the result of the other clinical studies[16,41] that demonstrated significant reduction in sensitivity of prepared teeth after application of gluma bond (glutaraldehyde based desensitizer) compared to control group. However systemp desensitizer resulted in statistically significant reduction in ($P<0.01$) in 5 minutes (3.4 ± 1.6), 1 day (1.9 ± 1.7), 1 week (0.6 ± 1.0) post cementation sensitivity level relative to baseline sensitivity level (4.3 ± 1.8). This finding was similar to other studies [18,49] that found significant reduction in sensitivity between baseline and post operative and 1 week response after gluma bond application.

DISCUSSION

Patients frequently experience pain or sensitivity in the prepared abutment teeth for some period of time following the placement of the restoration. While reported sensitivity tends to be short term that is several week or less,[1,4] some cases of prolonged sensitivity upto 1 year or longer have been reported, that eventually required endodontic therapy.[4,5]

A number of possible causes that increases the likelihood of abutment tooth sensitivity following tooth preparation during temporization phase and after the final cementation have been suggested including overly aggressive tooth preparation, poor provisional restorations, microleakage and bacterial contamination, removal of the protective smear layer, dessication of the preparation prior to cementation [6] and invivo dissolution of the luting agents at the poor margin of the restorations.[7]

Postoperative abutment tooth sensitivity has been associated with cements and crown cementation since the advent of zinc phosphate cement. Ever since the introduction of glass ionomer material as a luting medium for fixed restoration there has been considerable speculation regarding potential post cementation sensitivity. Many reasons for sensitivity from the glass ionomer luting agents has been postulated [15] including

i) Initial acidity of the cement and prolonged low pH of the cement during setting may irritate the pulp.[8] Prolonged acidity of the glass ionomer cement may exacerbate the dissolution of smear layer and peritubular dentine thereby increases the permeability of the dentine.
ii) Hydraulic pressure in the dentine tubules produced during cementation may enable the cement to enter dentinal tubules,[9,10] especially in preparation with minimal remaining dentine thickness with increased dentine permeability.
iii) Dehydration of the tooth-glass ionomer cements have high flow characteristics, if the dentinal canals are dehydrated and wide open it may be possible that there could be some irritation caused by cement.
iv) Water solubility during cementation-glass ionomer cement is water soluble immediately after mixing and it is possible that the cement in the margin of the restorations could dissolve out or be significantly disintegrated before initial cement set.
v) Post cementation microleakage associated with invivo dissolution of luting agents and subsequent bacterial leakage at the margin of restorations.

Furthermore glass ionomer cement has been reported to generate inflammatory changes in the pulp in the first 48 hours after placement of the material on the dentine.[16]

Post cementation sensitivity with glass ionomer cement is perplexing and the cause of the problem is still a matter of conjecture.

Although the perceived mechanism of pain transmission and sensitivity within the dentine is subject to speculation, the hydrodynamic mechanism of sensitivity is the most accepted. This theory postulates that the rapid shifts of the fluid in either direction within the dentinal tubules i.e. toward or away from the pulp, following stimulus application result in activation of sensory nerve ending thereby inducing pain or sensitivity.

The pressures that are generated during cementation of casting are transferred to the fluid in dentine, there is danger that the cement will enter the dentinal tubules before it sets displacing an equal volume of dentinal fluid in pulp.[17] This could be responsible for the pain that unanesthetized patients experience during cementation of restorations and could plausibly explain the hydrodynamic theory.

To reduce the risk of vital abutment sensitivity and for the preservation of health of pulpodentinal complex an alternative approach is the concept of sealing exposed dentine with desensitizing agents following tooth preparation and before cementation of restoration.[11,12] This would be a useful clinical procedure that may be beneficial and which is unlikely to be harmful.

It has been demonstrated that dentine permeability (ability of the fluid to shift across dentin) increases as dentine is prepared closer to pulp, hence it should be covered with materials that are biologically compatible with the pulp and will seal the dentine well. Sealing of dentine with bonding agent or desensitizing agent was suggested following tooth preparation and before making impression.[18] The thin film of these agents decreases the dentine permeability and would also prevent hydraulic fluid movement during impression making and during final luting of the restorations.

In office dentine surface treatment for the management of dentine hypersensitivity include the application of cavity varnishes, calcium hydroxide, various salts (fluoride, calcium, oxalate) that form insoluble precipitate within the dentinal tubules and sealing of dentinal tubules with restorative resin and adhesives (dentine bonding agents).

Desensitizing agents occlude the dentinal tubules at surface (at the tubular orifice) and subsurface (within the dentinal tubules) level preventing the fluid flow and hence reduces the pain sensation by counteracting the hydrodynamic mechanism of dentine hypersensitivity. Dentine bonding agent significantly reduced the pressure transmitted to the pulp chamber and had no effect on the post cementation crown seating Cherkasski and Wilson also suggested the pre-impression sealing of dentine should be considered for tooth preparation on vital teeth to reduce the pressure transmitted to the pulp chamber during crown cementation.[18]

Clinical efficacy of desensitizing agents in reducing the dentine sensitivity has been reported when applied on vital abutment teeth prepared to receive full coverage or PFM restoration.[16-18] However, their exact therapeutic action and clinical effectiveness for reducing the post cementation sensitivity level of glass ionomer cement is not clearly defined.

In the present study three in-office desensitizing agents were used namely, Bisblock dentine desensitizer (Oxalate based), Systemp desensitizer (glutaraldehyde based), and Tooth mousse desensitizer (Recaldent CPP-ACP casein phosphopeptide–amorphous calcium phosphate based) [Table 1]. Respective desensitizing agent was applied immediately after abutment preparation before the final impression was made.

Visual analogue scale (VAS) was used for assessment of sensitivity level as it offers the advantage of being a continuous scale, thus providing quantitative measurements that are readily averaged and tested with parametric statistics.[28] In many clinical studies VAS has been used extensively supporting it as a sensitive tool for measurements of the dentine sensitivity[21-26] and reliability was reported to be high when repeatedly used with the same individual.[27]

ISSN: 0975-8585

Evaluation of pre cementation sensitivity level:

In the present study at the time of baseline pre cementation, lower mean sensitivity VAS score to cold stimulus was seen in desensitizer groups compared to control group. Reduction in perceived sensitivity level score was seen in the following order. BB (1.8 $\pm$ 1.2) < GC (2.8 $\pm$ 2.1) < ST (4.3 $\pm$ 1.8) < C (5.1 $\pm$ 2.5) [Table 2, Graph II]. Overall application of all the three desensitizers had considerably reduced the pre cementation sensitivity of prepared abutment teeth. Difference in the precementation sensitivity level scores among the desensitizer groups may be due to the difference in their chemical composition and mechanism of actions.

Oxalate containing **Bisblock dentine desensitizer** application leads to formation of calcium oxalate crystals deep within the tubules that demineralizes the organic and mineral debris of the smear layer and the outermost ring of peritubular dentine and within minutes restructure the demineralized material as calcium oxalate precipitate.[32] It has been speculated that Bisblock reacts with calcium ions in 30 seconds to form calcium oxalate crystals in dentinal tubules and results in blockage of dentine fluid movement and eliminate sensitivity while leaving the dentine surface unobstructive and readily accept adhesion for indirect bonded restoration.

Systemp desensitizer contains polyethylene glycodimethacrylate and glutaraldehyde in an aqueous solution. Glutaraldehyde is biological fixative that superficially coagulates the plasmatic proteins of dentinal fluid resulting in partial or total occlusion of the dentinal tubules.[28,29] Thus desensitization, by preventing displacement of liquid across the tubules upon excitation. In the reaction of glutaraldehyde (GDA) with dentine two aldehyde groups present in GDA cross links with amino groups in the dentine collagen which facilitates protein precipitation inside the dentinal tubules (formation of aldehyde and protein cross linking).[28,30]

Transverse septae deep in the lumen of dentinal tubules has been displayed in the SEM specimens of desensitizer containing glutaraldehyde (Gluma desensitizer). It was concluded that the septae in the tubules may counteract the hydrodynamic mechanism of dentinal sensitivity and would theoretically desensitize the teeth.[30] Furthermore it was speculated that glutaraldeyde has distinct invivo antibacterial effect that inhibits the bacterial growth or invasion through a tooth-restoration interface.[31] It may be expected that desensitizers containing glutaraldehyde might help in reducing the abutment sensitivity associated with microleakage at cervical margins of restoration conceivably by effectively eliminating bacterial contamination.

Tooth mousse desensitizer contains the active ingredient Recaldent CPP-ACP (casein phosphopeptide – Amorphous calcium phosphate) which desensitizes the surface with its ability to remineralize the hard tissues. ACP is capable of rapid conversion into hydroxyapatite crystals under physiologic oral conditions which can precipitate in the lumen of the dentinal tubules. Tung and others have also shown that calcium phosphate solution at high concentration and at pH 5 rapidly precipitate amorphous calcium phosphate that obstruct the dentinal tubules and decreases the dentine permeability by 85% or more. Moreover when CPP-ACP is applied to tooth surface it binds to biofilms, bacteria hydroxyapatites and surrounding soft tissues localizing the bio-available calcium and phosphate. Saliva will also enhance the effectiveness of CPP-ACP.

Comparison of efficacy of desensitizing agent:

When comparison was made within desensitizer groups to compare the relative efficacy of desensitizing agent tested in the present study.

Bisblock and GC tooth mousse desensitizer resulted in statistically significant reduction ($P<0.01$) in post cementation sensitivity of glass ionomer cement in comparison to systemp desensitizer at 5 min, 1 week post cementation time interval with no statistical difference was seen between all desensitizer groups at 1 day post cementation. (Table 2)

Bisblock and GC desensitizer group (Table 7, Graph 3) resulted in statistically highly significant ($p< 0.001$) percentage reduction in sensitivity level at 5 min, 1 day, 1 week post cementation relative to baseline sensitivity level in comparison to systemp desensitizer. In Bisblock desensitizer group reduction in post cementation mean VAS score at different time intervals was 5 minute (1.1 ± 0.7), 1 day (0.3 ± 0.7), 1 week (0.0 ± 0.0) relative to baseline pre cementation VAS score (1.8 ± 1.2).

With the application of oxalate containing desensitizer, greater reduction in mean VAS score from the baseline to various time intervals has been demonstrated in many clinical studies.[18,25,14]

Application of Bisblock and GC tooth mousse desensitizer resulted in 100% reduction in sensitivity level at the end of 1 week relative to baseline sensitivity level compared to systemp desensitizer (86% reduction) and control (80% reduction). (Table 4, Graph 3). This indicates the efficacy of bisblock and GC tooth mousse desensitizer was more in relieving the post cementation sensitivity of glass ionomer cement at various time intervals in comparison to systemp desensitizer.

Clinical efficacy of desensitizing agents depends on dissolution resistance or solubility level of precipitate or resin in the dentinal tubule. Superficial smear layer or desensitizing precipitate can be dissolved in clinical environment (saliva, dentinal fluid or acid produced by bacterial metabolism). It has also been stated that prolonged acidity (low pH) of the glass ionomer cement during setting may exacerbate the dissolution of existing layer.[8]

Dentine surface treatment with soluble acidic oxalate salts has been demonstrated to remove the original smear layer and replace it with an acid resistant layer of calcium oxalate crystals.[32] This might be the reason application of bisblock oxalate containing desensitizer on prepared abutment teeth in the present study resulted in greater reduction in postcementation sensitivity of glass ionomer cement by counteracting the initial acids of the cement by acid resistant precipitate that otherwise might have dissolved the pretreatment smear layer on exposed dentine.

Furthermore the layer of acid resistant crystalline precipitates not only occlude the dentine and reduce dentine permeability also provide a surface rich in calcium and carboxylate group which might be useful for chemical bonding of glass ionomer cement to dentine.

At present there is insufficient data with regard to both clinical efficacy and potential mode of action of GC tooth mousse desensitzer containing recaldent CPP-ACP used in the present study. However results of the present study showed GC tooth mousse desensitizer was considerably effective in relieving the pre and post cementation sensitivity at various time intervals. Moreover application of tooth mousse desensitizer does not require surface conditioning or the application of resins or polymer making treatment much more compatible.

When comparison was made between the sensitivity level of abutment teeth to thermal and bite stimulus no statistical difference was seen in perceived sensitivity score between the three desensitizer groups at 1 day and 1 week post cementation time interval ($p < 0.05$) (Table 3 & 6).

Patient's subjective response to thermal stimuli was zero and was not discriminative among all the desensitizer groups. Overall only 2-3 subjects in all the groups responded sensitivity to bite stimulus and scored in the range of 0-2 on the VAS. The subjective response to the bite stimulus was clinically non-significant among all the desensitizer groups.

In the present study in contrast to reduction in VAS scores following cold, hot and bite stimuli, the reduction in VAS scores following the cold stimuli were more discriminative among all the desensitizer groups. The reason for this is not clear but could result from the relatively greater number of dentinal tubules that are potentially stimulated by cold compared to hot and bite stimuli. It has been speculated that stimulus such as cold which causes fluid flow away from the pulp produce more rapid and greater pulp nerve response than heat which causes inward flow supporting the result of the present study.

In a comparative clinical study that evaluated the post cementation sensitivity level of glass ionomer and zinc phosphate cement, clinically insignificant and low sensitivity level to bite stimulus was found before and after cementation.[2] It was also stated that sensitivity to cold is generally the most discriminative test compared to other stimuli since the cold stimulus generates more positive histories and higher magnitudes with direct test.[2]

The present study analyzed the immediate effects of desensitizing agents at relatively short observation period. Short observation period employed may preclude the extrapolation of the long term efficacy of the desensitizers evaluated in relieving the post cementation sensitivity over time.

SEM examination of dentine surface would have provided more understanding of the potential occluding effect of desensitizing agents and also more meaningful conclusion would have been drawn conjointly with the present clinical investigation.

It is encouraging that desensitizer's application on the prepared abutment teeth considerably effective in relieving both pre and post cementation sensitivity for full coverage restoration over the short duration of time. Immediate reduction in post-operative sensitivity relatively in a short time period may be beneficial in terms of patient's comfort. Nonetheless, multicenter long term clinical trials should be conducted to confirm the results.

CONCLUSION

Efficacy of Bisblock and GC tooth mousse desensitizer was more in relieving the post cementation sensitivity of glass ionomer cement at various time intervals in comparison to systemp desensitizer. 100% reduction in sensitivity level was seen with the application of Bisblock and GC tooth mousse desensitizer compared to systemp desensitizer (86%) and control (80%) at the end of 1 week relative to baseline sensitivity level. In conclusion application of desensitizers was beneficial to reduce the pre and post cementation abutment sensitivity.

REFERENCES

[1] Brackett WW, Metz JE. Performance of a glass ionomer luting cement over 5 years in a general practice. J Prosthet Dent 1992;67:59-61.
[2] Johnson GH, Powell LV, Derouen TA. Evaluation and control of post cementation pulpal sensitivity: Zinc phosphate and glass ionomer luting cements. J Am Dent Assoc 1993;124:39-46.
[3] Reinhardt JW. Swift EJ, Bolden AJ. A National survey on the use of Glass-ionomer cements. Oper Dent 1993;18:56-60.
[4] Jokstad A, Mijor IA. Ten year's clinical evaluation of three luting cements. J Dent 1996;24(5):309-315.
[5] Jackson CR, Skidmore AE, Rice RT. Pulpal evaluation of teeth restored with fixed prostheses. J Prosthet Dent 1992;67:323-5.
[6] Brannstrom M. The effect of dentine desiccation and aspirated odontoblast on the pulp. J Prosthet Dent 1968;20:165-71.
[7] Phillips RW, Swartz ML, Lund MS, Moore BK, Vickery J. In vivo disintegration of luting cements. J Am Dent Assoc 1987;114:489-492.
[8] Smith DC, Ruse ND. Acidity of glass ionomer cements during setting and its relation to pulp sensitivity. J Am Dent Assoc 1986;112:654-657.
[9] Council on Dental Materials, Instruments and Equipment. Reported sensitivity to glass ionomer luting cements. J Am Dent Assoc 1984;109:476.
[10] Gerzina TM, Hume WR. Movement of glass ionomer cement through human dentine during crown cementation in vitro. J Dent Res 1990;Abstract 15:934.

[11] Brannstrom M. Reducing the risk of sensitivity and pulpal complications after the placement of crowns and fixed partial dentures. Quintessence Int 1996;27:673-678.
[12] Lam CW, Wilson PR. Crown cementation and pulpal health. Int Endod J 1999;32:249-256.
[13] Felton DA, Bergenholtz G, Kanoy BEd. Evaluation of the desensitizing effect of Gluma dentin bond on teeth prepared for complete-coverage restorations. Int J Prosthodont 1991;4:292-298.
[14] Zhang HQ, Chao YL. The effects of desensitizing bonding system for prevention of vital abutment hypersensitivity. Hau Xi Kou Qiang Yi Xue Za Zhi 2005;23(2):130-2.
[15] Christensen GJ. Glass ionomer as a luting material. J Am Dent Assoc 1990;120:59-62.
[16] Plant CG. Pulpal effects of glass ionomer cement. Int Endod J 1984;17:51-59.
[17] Pashley DH. Smear layer physiological considerations. Oper Dent 1984;(suppl 3):13-29.
[18] Richardson D, Tao L, Pashley DH. Dentin permeability: Effects of crown preparation. Int J Prosthodont 1991;4:219-225.
[19] Lam CW, Wilson PR. The effect of dentine surface treatment on pulpward pressure transmission during crown cementation: a laboratory study. Int Dent J 1998;8:196.
[20] Holland GR, Narhi 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.
[21] Quarnstrom F, Collier N, McDade E, McLean K, Munk AL, Nicholls J. A randomized clinical trial of agents to reduce sensitivity after crown cementation. General Dentistry 1998;71:68-74.
[22] Wolfart S, Wegner SM, Kern M. Comparison of using calcium hydroxide or a dentine primer for reducing dentinal pain following crown preparation: a randomized clinical trail with an observation time up to 30 months. J Oral Rehabil 2004;31:344-350.
[23] Kontturi-Narhi V. Narhi M. Testing sensitive dentine in man. Int Endod J 1993;26:4.
[24] Yates R, Owens J, Jackson R, Newcombe RG, Addy M. A split-mouth placebo-controlled study to determine the effect of amorphous calcium phosphate in the treatment of dentine hypersensitivity. J Clin Periodontol 1998;25:687-692.
[25] Geiger S, Matalon S, Blasbalg J, Tung MS, Eichmiller FC. The clinical effect of amorphous calcium phosphate (ACP) on root surface hypersensitivity. Oper Dent 2003;28(5):496-500.
[26] Stewardson DA, et al. The effectiveness of systemp desensitizer in the treatment of dentine hypersensitivity. Primary Dental care 2004;11(3):71-76.
[27] Sim J, Waterfield J. Validity, reliability and responsiveness in the assessment of pain. Physiotherapy Theory and Practice 1997;13:23-37.
[28] Dijkman G, Jongebloed WL, de Vries J, Ogaard B, Arends J. Closing of dentinal tubules by glutardialdehyde treatment, a scanning electron microscopy study. Scand J Dent Res 1994;102:144-50.
[29] DondiDall'Orologio G, Lone A, Finger WJ. Clinical evaluation of the role of glutardialdehyde in a one-bottle adhesive. Am J Dent 2002;15:330-334.
[30] Schupbach P, Lutz F, Finger WJ. Closing of dentinal tubules by gluma desensitizer. Eur J Oral Sci 1997;105:414-421.
[31] Felton DA, Bergenholtz G, Cox CF. Inhibition of bacterial growth under composite restorations following GLUMA pretreatment. J Dent Res 1989;68(3):491-495
[32] Pashley DH, Galloway SE. The effects of oxalate treatment on the smear layer of ground surfaces of human dentine. Archs Oral Biol 1985;30(10):731-737.