A Comparative Study on the Effect of Propolis and Dentine Bonding Agent in Treating Dentin Hypersensitivity: A Randomized Clinical Trial.

A RESEARCH PROPOSAL

By

Dr. Ather Akber

MSc.DS Periodontology

Batch-I

Submitted to the Scientific Committee Dow University of Health Sciences

In partial fulfillment of the requirement For the Degree of

Master of Science - Dental Surgery

Periodontology

Dated: 30th May' 2018

Approved by: Board of Advanced Studies and Research (BASR)

RESEARCHER:

Name: Dr. Ather Akber

Designation: Lecturer, Post graduate trainee

Department: Periodontology

Qualification: BDS, MSc.DS Trainee

Signature: _____

SUPERVISOR:

Name: Dr. Shahbaz Ahmed

Designation: Associate Professor

Department: Operative dentistry

Qualification: BDS, MSc, FCPS

Signature: _____

Table of Contents

Abstract: ..... **Error! Bookmark not defined.**

Chapter 1: Introduction 5

1.1 Background: 5

1.2 Literature Review: 7

1.3 Rationale of the Study: 10

1.4 Statement of Problem 10

1.5 Objectives 10

1.6 Hypothesis. 10

1.7 Operational Definitions: 11

Chapter 2: Methodology 12

2.1 Study Design: 12

2.2 Study Setting: 12

2.3 Study Duration: 12

2.4 Study Population: 12

2.4.1 Inclusion Criteria: 12

2.4.2 Exclusion Criteria: 13

2.5 Sample Size: 13

2.6 Sampling Technique: 14

2.7 Data Collection Procedure: 15

2.8 Data Analyses: 18

2.8.1 Study Variables: 18

2.8.2 Statistical Analysis 18

2.9 Ethical considerations: 18

2.10 Study Time line: 19

2.11 Budget: 19

Chapter 3: References: 20

APPENDIX-I 23

APPENDIX-II 24

APPENDIX-III 25

ABSTRACT

Background:

Dentin Hypersensitivity causes considerable pain and discomfort to an individual due to number of stimuli on exposed dentine. Different kinds of treatment strategies used in the resolution of Dentine hypersensitivity including the use of Propolis and Dentine Bonding Agent. No study has compared the efficacy of Propolis and Dentine Bonding Agent.

Objectives:

Comparison of the efficacy of Propolis and Dentine Bonding Agent in the treatment of Dentin Hypersensitivity.

Methods:

In this six month In- Vivo single blinded Randomized Clinical Study, a total number of 50 patients with complain of dentine hypersensitivity will be selected in two groups after taking consent. Group A and B will receive Propolis and Dentine Bonding Agent respectively by a trained operator. Recordings of Dentin Hypersensitivity will be obtained at Day 0, before and after the application of experimental agents, and also on Day 7, 15 and 30 by the Researcher. Response will be measured by Visual Analog Scale and Schiff Cold Air Sensitivity Scale. SPSS v.20 will used to analyze the data with level of significance set at $p < 0.05$. Friedman test will be applied to see the comparison within groups and Wilcoxon Signed Rank test will be used for Pairwise comparison. Mann Whitney U-Test will be applied for comparison between groups.

Key Words: Dentin Hypersensitivity, Propolis, Dentine Bonding Agent, Visual Analog Scale (VAS), Randomized Clinical Trail, Schiff Cold Air Sensitivity Scale

CHAPTER 1: INTRODUCTION

1.1 Background

Dentin Hypersensitivity can be defined as "Short acting, sharp pain that arises from exposed dentine due to various stimuli which is evaporative, thermal, osmotic, tactile and chemical and this pain cannot be attributed to any other form of dental defect, disease or pathology [1, 2]. Many other terms have been used to diagnose this typical common condition such as Dentine Sensitivity, Root sensitivity, cervical dentine sensitivity, cemental hypersensitivity but Dentin Hypersensitivity is the most often used term across the literature [3].

It has been reported that Dentin Hypersensitivity has multifactorial etiology and patients with periodontal and gingival disease usually encounter this painful condition [4]. Dentin Hypersensitivity is initiated by denudation of dentinal tubules and several possible common causative factors which include gingival recession, pockets formation, acute and chronic inflammatory periodontal diseases, trauma, traumatic occlusal forces, parafunctional habits, acidic dietary components, abrasion, erosion, attrition, abfraction, tooth flexure, faulty and overzealous tooth brushing and periodontal procedures (specially Scaling and Root planing) lead to dentine exposure [5-7].

Dentin Hypersensitivity as reported by Canadian Advisory Board is Diagnosis of Exclusion [2]. It is diagnosed by means of self-report of sharp pain in vital tooth/ teeth by patients in response to external stimuli. [8].

A number of theories have been put forward to describe the mechanism of Dentin Hypersensitivity [9] but Brannstorm's Hydrodynamic Theory is the most widely acceptable theory

and according to this theory, various stimuli cause changes in fluid movements in dentinal tubules either outwards or inwards, resulting in activation of nocireceptors in pulpodentinal border, which ultimately lead to the characteristic short, sharp pain of Dentin Hypersensitivity [10, 11].

Variation in Prevalence of Dentin Hypersensitivity exists worldwide, ranging from 1.34% to 98%[12-14]. This presence of variation exists due to several reasons including different study designs, different selection criteria for each study sample, different diagnostic approaches and also type of setting where study was performed [15, 16].

As understanding of the cause of Dentin Hypersensitivity, the most appropriate treatment would be occlusion and blockage of exposed dentinal tubules and inhibition of the movement of intratubular fluid and the agents which have ability to seal and occlude the dentinal tubules are ideal for the treatment of Dentin Hypersensitivity [17, 18]. Based on the mechanism of action, different agents have been widely used all around the world for the treatment of Dentine Hypersensitivity. Potassium nitrate used as a Nerve desensitizing agent and is widely used in dentifrices. Gluteraldehyde, Silver nitrate, Zinc chloride, Strontium chloride hexahydrate used as Protein precipitating agents and used in the treatment of Dentine Hypersensitivity by occluding patent tubules. Sodium fluoride, Stannous fluoride, Strontium chloride, Calcium phosphate, Calcium carbonate, Bio active glasses used as dentinal tubules Plugging agents. Fluoride varnishes, Oxalic acid and resin, Glass ionomer cements, Composites, Dentin bonding agents used as Dentine adhesive sealers. Lasers such as Neodymium:yttrium aluminum garnet (Nd-YAG) laser, GaAlAs (galium-aluminium-arsenide laser), Erbium-YAG laser nowadays also used for the treatment of Dentin Hypersensitivity. Researches have been taking place on several other

materials among which Propolis is of special interest which has been used in homeopathic and herbal practices since long time [19, 20].

1.2 Literature Review

The properties of ideal desensitizing agent are that they should not irritate the pulp or cause discomfort on application or later on, easily applicable, effective long lastingly and it should not stained the teeth, as described by Grossman [21]. Such treatment has not been discovered so far.

There is no Standard treatment till date for Dentine Hypersensitivity and this study aims to find one. Adhesive restoration materials and dentinal adhesives are considered dentinal tubule sealers and with the ability of sealing open dentinal tubules, it is used in the treatment of Dentin Hypersensitivity [20]. Reduction in Dentin Hypersensitivity with the application and penetration of resins for occlusion of dentinal tubules was suggested by Dayton et al and Nordenvell & Brannstorm [22, 23]. Various studies found the significant effect of Dentine Bonding Agent in the reduction of Dentin Hypersensitivity[24-27]. In a study conducted in Thailand, in 2008 by Tasanee Tengrungsun et al reported a significant reduction of Dentin Hypersensitivity by Dentine Bonding Agent and it was also superior to other experimental agent i.e. GaAIAs laser [27]. Prati C. et al reported a significantly decrease in Dentin Hypersensitivity with respect to the baseline values just after 10 minutes by Dentine Bonding Agent[24]. Other studies also found a significant relief in the symptoms of Dentin Hypersensitivity when treated with Dentine Bonding Agent [25, 26]. Duran et al in randomized split mouth study design concluded that Dentine Bonding Agents

significantly reduce the symptoms of Dentin Hypersensitivity and will be used in the treatment of Dentin Hypersensitivity [28].

Dental adhesives technologies advance through many generations with changes in their mechanism, application technique, clinical effectiveness and number of steps. Seventh generation is the easiest and advanced adhesive system which is one step self-etch system combines the etchant, primer and bonding resin in a single application. This All in one adhesive system contains acidic functional monomers, hydrophobic and hydrophilic monomers, organic solvents and water into a single solution. [29] Less postoperative sensitivity, reduced technique sensitivity and simplified clinical application are the advantages that made self-etching system a favorable system than etch and rinse system. 3M ESPE Scotchbond™ Universal Adhesive system is a Seventh generation one-step self-etch adhesive system which is indicated in sealing of dentinal tubules and this can be used in the treatment of Dentin Hypersensitivity.

Propolis is naturally occurring, resinous, non- toxic honey bee (*Apis mellifera*) product, collected from living plants. In homeopathic and herbal practice, it is widely used as anti-inflammatory, anti-septic and in treating different diseases as both local and systemic applications. The word "Propolis" is derived from Greek word "Pro" (in front of, at the entrance to) and "Polis" (city or community) and means a defender of a city or community. Bee glue is sometime used as a synonym for Propolis [30]. Due to its botanical origin, variation exists in Propolis composition therefore geographical location is a major determinant of its composition. It is generally composed of a mixture of 50- 60% resins and vegetable balsam , 35% waxes, 5-10% essentials and aromatic oils, 5- 10% Pollen, and 10- 15% other constituents such as Vitamin A, Vitamin B-complex, Vitamin E, amino acids, minerals, and other compounds and highly active biochemical substances known as Bioflavonoids. Bioflavonoids (flavones, flavonones and flavonols) are well

recognized plant extracts which have the properties of anti-bacterial, anti-viral, anti-inflammatory, anti-oxidative and anti-fungal[30-32].

There are various studies showing the uses of Propolis in dentistry and also in medicine and surgery. In medical science, Propolis is used as an anti-asthmatic, supports respiratory system, used to provide immunity against tumor cells, helps in tissue repair, diabetes control, photo inhibitor and for several other reasons[33-35]. In dentistry, it provides relief from denture ulcerations and stomatitis, halitosis, periodontal pocket and abscess. It is also used as intracanal medicament for antimicrobial activity, to prevent dental caries, for acceleration and healing of oral tissues, reduction in pulp inflammation and also in reduction of Dentin Hypersensitivity[35-39]. There are various in vitro and in vivo studies which show the effect of Propolis in reduction of Dentin Hypersensitivity[36, 40-48]. Almas K et al reported that Propolis is better in occluding dentinal tubules than Saline[41]. Torwane et al concluded that Propolis showed significant reduction in Dentin Hypersensitivity[47]. Rana Al-Haj Hussain et al reported that Dentin Hypersensitivity which occurred due to chair-side tooth bleaching procedure could be successfully reduced by using Propolis.

In the previous studies, Propolis and Dentine Bonding Agents had a significant reduction in Dentine Hypersensitivity, but none of the study in the available literature had a comparison between Propolis and Seventh generation Dentine Bonding Agent for the treatment of Dentine Hypersensitivity. This study will test the Propolis and Seventh generation Dentine Bonding Agent as Desensitizing agents to find out which is more effective in treating Dentine Hypersensitivity.

1.3 Rationale of Study

Various researches have been done which show the significant effect of Propolis and Dentine Bonding Agents in the resolution of Dentin Hypersensitivity. But in the literature available, the comparative evaluation of Propolis and Dentine Bonding Agent has not been performed. So this study will compare the efficacy of Propolis with Dentine Bonding Agent in the treatment of Dentin Hypersensitivity. This study will further signify best regime in long-term success for the treatment of Dentin Hypersensitivity among the two options.

1.4 Statement of Problem

Use Propolis and Seventh generation Dentine Bonding Agent for the treatment of Dentine Hypersensitivity.

1.5 Objectives

The objective of this study is to explore which is more effective between Propolis and Seventh generation Dentine Bonding Agent for the treatment of Dentine Hypersensitivity.

1.6 Null Hypothesis

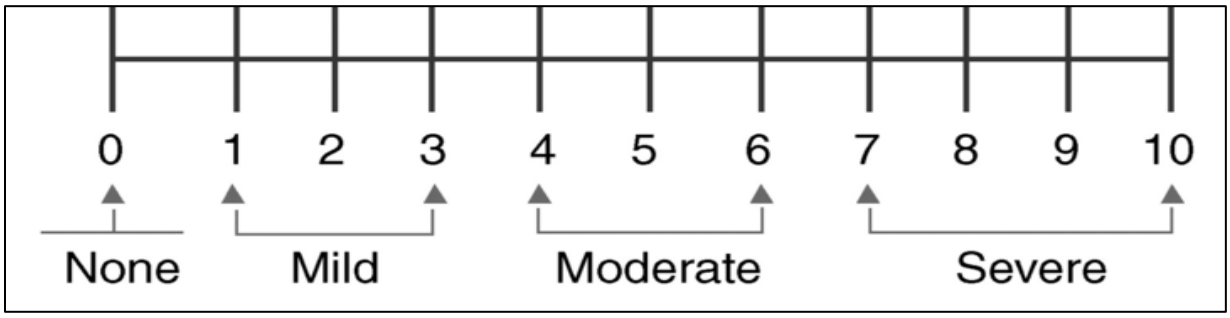
There is no difference in the efficacy of Propolis and Dentine Bonding Agent in the treatment of Dentin Hypersensitivity

1.7 Operational Definitions:

Dentine Hypersensitivity: Painful condition that arises from exposed vital dentine due to external stimulation of exposed dentinal tubules. [1, 2]

Scaling and root debridement [SRD]: Scaling refers to the removal of plaque and calculus from the tooth surface whereas debridement is the removal of the necrotic cementum from the root surface.

Visual Analog Scale [VAS]: A Visual Analogue Scale (VAS) is a measurement instrument for subjective characteristics or attitudes that cannot be directly measured. This psychometric response scale is frequently used in epidemiologic and clinical research to measure the intensity or frequency of various symptoms.



Schiff cold air sensitivity scale[49]: This scale is mainly used to evaluate subject response to a stimulus like air or evaporative. This scale is scored as follows:

1. Subject does not respond to air stimulus.
2. Subject responds to air stimulus but does not request discontinuation of stimulus.
3. Subject responds to air stimulus and requests discontinuation or moves from stimulus.
4. Subject responds to air stimulus, considers stimulus to be painful, and requests discontinuation of the stimulus.

CHAPTER 2: METHODLOGY

2.1 Study Design:

A Single blinded Randomized Clinical Trial.

2.2 Study Setting:

This singled- centered Study will be conducted in Periodontology Department of Dow International Dental College (DIDC) of Dow University of Health Sciences (DUHS).

2.3 Study Duration:

Study will be conducted in six months after approval of the synopsis

2.4 Study Population:

2.4.1 Inclusion Criteria:

1. Subjects included in this study will be selected from outpatients attending the periodontology department of DIDC for the problem of Dentin Hypersensitivity.
2. Healthy males or females of 20- 45 years of age and will have at least 2 vital teeth with hypersensitivity on facial surfaces to evaporative stimulus.
3. Patients with Miller's Class I and II gingival recession will be included.
4. Patients with Score I of Silness and Loe Plaque Index[50].
5. The patients should have no systemic and mental illness.
6. Patients who used Flouride dentifrices for hypersensitivity but could not get relief from it.

2.4.2 Exclusion Criteria:

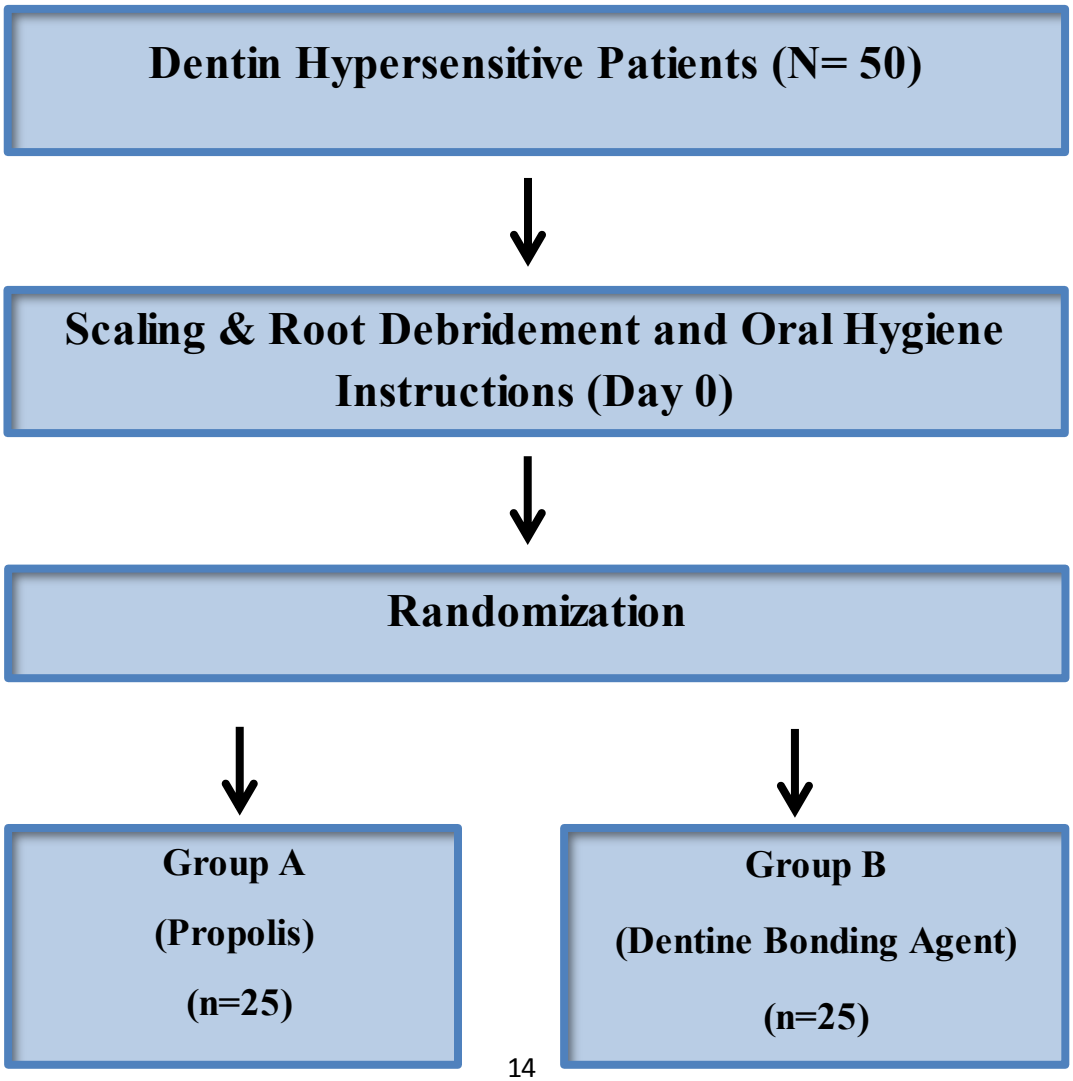
1. Patients with Carious, Cracked or Restored teeth, Abutment teeth used of Removable or Fixed Prosthesis and tooth with any other dental pathology.
2. Patients using analgesics, mood alteration drugs during last six months.
3. Smoker, pregnant and nursing mothers.
4. Patients using tooth whitening or bleaching agents in the last six months,
5. Patients undergoing orthodontic therapy and history of periodontal surgery during last six months.
6. Patients who refuse to give consent.
7. Patients who had Score 2 and 3 of Calculus index will also be excluded from this study.

2.5 Sample Size:

Total 50 patients will be carried out (25 in each group). Using PASS version 11, test for Pair means with 99% Confidence Interval and Power of test, mean difference of degree of sensitivity 1.8 (1.9 – 0.01) [27] and 0.42 of Standard Deviation difference (3.35 – 2.93) [27], sample size is 5 patients per group which we have increased to 25 patients per group.

2.6 Sampling Technique:

Diagnosis of Dentine Hypersensitivity will be made by obtaining detailed dental history and clinical examination of the patients prior to include in the study. History and clinical examination will eliminate and exclude the other forms and causes of Dentine Hypersensitivity which will not meet the inclusion criteria of this study. Definitive diagnosis of Dentine Hypersensitivity will be made by using Evaporative or Air blast stimulus from triple dental syringe on the sensitive surface. Then participants will be allocated to two groups through sealed envelope method. Groups will be named as Group A (Propolis) and Group B (Dentine Bonding Agent). It will only be disclosed out at the time of application of desensitizing agents by Operator.



2.7 Data Collection Procedure:

After explanation of the procedure, efficacy and safety of the materials used, possibilities of receiving either treatment options that is Propolis or Dentine Bonding Agent, the patients will be asked to sign a consent form at first (Appendix I & II). After the consent, a complete history will be obtained from the patient regarding his systemic health, medications, dental treatment and hygiene habits and smoking (Appendix III).

At baseline (Day 0), thorough oral prophylaxis will be done for all the patients which include Scaling & Root Debridement with Polishing and detailed oral hygiene instructions should be given. Scaling is recommended to remove plaque, calculus and food remnants so clean tooth surface will be available for application of Propolis and Dentine Bonding Agent. Subjects will be provided with kit containing same type of standard Toothpaste (Colgate® Maximum Cavity protection PLUS Sugar Acid Neutralizer™) and Toothbrush (Colgate® 360° Sensitive Pro-Relief™) for oral hygiene during research time. Proper tooth brushing technique will be explained and demonstrated to each and every patient. Dietary counseling will also be done in order to avoid intake of excessive acids during study period.

After debridement, pretreatment assessment will be done by trained examiner. To evaluate and assess Dentin Hypersensitivity, Evaporative stimulus (controlled air blast stimulus) will be used from dental triple syringe or air water syringe which will be directed onto the affected area from a distance of 10mm for up to two seconds with complete isolation of the adjacent teeth by cotton roll. Responses will be measured on 10 cm line on Visual Analog Scale (VAS)[52] which will be scored as 0 (No Pain), 1-3 (Mild Pain), 4-6 (Moderate Pain) and 7-10 (Severe Pain). Another scale names Schiff Cold Air Sensitivity Scale[49] will be used to measure response graded as 0, 1,

2, 3. Responses from all patients will be recorded by a single examiner, who will be blind to the applied desensitizing agents.

The patients will be allocated in to two respected groups, according to randomization by the process of sealed envelopes. The groups will be divided according to the desensitizing agents. Group A includes patients that will receive Propolis as a treating agent. Propolis obtained from Margalla hills, Islamabad by NARC (National Agriculture Research Council, Islamabad). Plant source origin is *Acacia modesta and Apis mellifera* bees collect it. The 30% ethanolic extract of Propolis from raw Propolis will be obtained in Pakistan Council of Scientific & Industrial Research (PCSIR) by dissolving the Propolis in 95% Ethanol and straining out the precipitate. Group B includes patients that will receive Dentine Bonding Agent (Scotchbond™ Universal Adhesive, 3M ESPE Dental Products, St. Paul, MN, USA).

Only the Principal Investigator will be blind to the intervention given to the participants. Application of desensitizing agents to participants will be carried out by trained and experienced operator and it will only be disclosed to operator at the time of application. Operator will inform the participant about the intervention before applying and patients will not be blinded. Desensitizing agents will be applied on day 0 (baseline). Complete isolation of proximal sides from hypersensitive teeth will be done by using cotton rolls. Hypersensitive teeth surfaces will be dried by cotton pellets. Propolis will then be applied by brush on sensitive surfaces and left undisturbed for 60 seconds to let it dry. Application of Dentine Bonding Agent on sensitive surfaces will be applied single coated for 20 seconds, gently apply air for 5 seconds and cure for 10 seconds (as manufacturer's instructions). For Score 4-6 s(Moderate Pain) & 7-10 (Severe Pain) on VAS and grade 3 (Subject responds to air stimulus, considers stimulus to be painful and requests discontinuation of stimulus) of Schiff Cold Air Sensitivity Scale, application of Propolis

and Dentine Bonding Agent will be applied under Local Anesthesia and response will be recorded on next day.

Care should be taken to ensure that none of the products will touch other areas of oral mucosa. Patients will be instructed not to rinse, drink or eat for half an hour after the application of treatment agents and avoid using any desensitizing dentifrices during the course of investigation.

The clinical evaluation of Dentin Hypersensitivity will be done before and after the application of Desensitizing agents at baseline (Day 0), and also on day of re-assessment at 7^{th}, 15^{th} and 30^{th} day (Appendix III).

2.8 Data Analysis:

2.8.1 Study Variables:

Independent Variables:

- Sessions (Days)
- Groups

Dependent Variables:

- Visual Analog Scale (VAS)
- Schiff Cold Air Sensitivity Scale

2.8.2 Statistical Analyses:

Statistical Package for Social Sciences (SPSS) version 20 will be used to analyze the data. The level of statically significance will be set at $p < 0.05$. to see the comparison within groups, Friedman test will be applied. For Pairwise comparison, Wilcoxon Signed Ranked Test will used. For between groups comparison, Mann- Whitney U- Test will be applied.

2.9 Ethical considerations:

The present study will be non-offensive and secure for the participants. Participants will be selected voluntarily and the informed consent is mandatory to be signed. The participant's data will be kept confidential. The participants will not be forced to continue the study if they are unwilling to continue after selection. Final results will be disclosed to the patients once the study has completed. The desensitizing agents and procedures that will be used in present study were

tested before in many other studies and there are no reported incidences of adverse outcome and complexity regarding their use.

2.10 Study Time Line

S.NO	WORKING STEPS	TIME (MONTHS)					
		1	2	3	4	5	6
1.	Data collection						
2.	Data processing/ Analysis						
3.	Thesis writing						

2.11 Budget:

S.NO	EXPENSE	AMOUNT
1.	Instruments and Material	10000/=
2.	Printing	15000/=
3.	Dentine Bonding Agent	25000/=
4.	Propolis	25000/=
5.	Miscellaneous	10000/=
6.	Incentives	15000/=
	TOTAL	**100,000/=**

CHAPTER 3: REFERENCES AND APPENDICES

1. Cunha-Cruz J, Wataha JC, Heaton LJ, Rothen M, Sobieraj M, Scott J, et al. The prevalence of dentin hypersensitivity in general dental practices in the northwest United States. J Am Dent Assoc. 2013;144(3):288-96.
2. Hypersensitivity CABoD. Consensus-based recommendations for the diagnosis and management of dentin hypersensitivity. J Can Dent Asso. 2003;69(4):221.
3. Al-Khafaji H. Observations on dentine hypersensitivity in general dental practices in the United Arab Emirates. Eur J Dent. 2013;7(4):389.
4. Chu C-H, Lo EC-M. Dentin hypersensitivity: a review. Hong Kong Dent J. 2010;7(1):15-22.
5. Bartold P. Dentinal hypersensitivity: a review. Aust Dent J. 2006;51(3):212-8.
6. Ahmed T, Mordan N, Gilthorpe M, Gillam D. In vitro quantification of changes in human dentine tubule parameters using SEM and digital analysis. J Oral Rehabil. 2005;32(8):589-97.
7. Uraz A, Erol-Simsek Ö, Pehlivan S, Suludere Z, Bal B. The efficacy of 8% Arginine-CaCO3 applications on dentine hypersensitivity following periodontal therapy: a clinical and scanning electron microscopic study. 2013.
8. Holland G, Narhi M, Addy M, Gangarosa L, Orchardson R. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. J Clin Periodontol. 1997;24(11):808-13.
9. West N, Lussi A, Seong J, Hellwig E. Dentin hypersensitivity: pain mechanisms and aetiology of exposed cervical dentin. Clin Oral Investig. 2013;17(1):9-19.
10. Brännström M. Sensitivity of dentine. Oral Surg Oral Med Oral Pathol. 1966;21(4):517-26.
11. Matthews B, Andrew D, Wanachantararak S. Biology of the dental pulp with special reference to its vasculature and innervation. Tooth Wear and Sensitivity London, Martin Dunitz. 2000:39-51.
12. West NX, Sanz M, Lussi A, Bartlett D, Bouchard P, Bourgeois D. Prevalence of dentine hypersensitivity and study of associated factors: a European population-based cross-sectional study. J Dent. 2013;41(10):841-51.
13. Chabanski M, Gillam D, Bulman J, Newman H. Clinical evaluation of cervical dentine sensitivity in a population of patients referred to a specialist periodontology department: a pilot study. J Oral Rehabil. 1997;24(9):666-72.
14. Bamise CT, Olusile AO, Oginni AO, Dosumu OO. The prevalence of dentine hypersensitivity among adult patients attending a Nigerian teaching hospital. Oral Health Prev Dent. 2007;5(1).
15. AKBER A, ALI NS, SHABBIR S, WAHID U, FAROOQUI WA. FREQUENCY OF DENTINE HYPERSENSITIVITY: A CROSS-SECTIONAL STUDY. Pak Oral Dental J 2016;36(3).
16. Splieth CH, Tachou A. Epidemiology of dentin hypersensitivity. Clin Oral Investig. 2013;17(1):3-8.
17. Parolia A, Kundabala M, Mohan M. Management of dentinal hypersensitivity: a review. J Calif Dent Assoc. 2011;39(3):167-79.
18. ROSA RRM, CALAZANS FKS, NOGUEIRA RD, LANCELLOTTI ACRA, GONÇALVES LdS, GERALDO-MARTINS VR. Effects of different desensitizing treatments on root dentin permeability. Braz Oral Res. 2016;30(1).

19. Miglani S, Aggarwal V, Ahuja B. Dentin hypersensitivity: Recent trends in management. J Conserv Dent. 2010;13(4):218.
20. Porto IC, Andrade AK, Montes MA. Diagnosis and treatment of dentinal hypersensitivity. J Oral Sci. 2009;51(3):323-32.
21. Grossman LI. A systematic method for the treatment of hypersensitive dentin. J Am Dent Assoc (1922). 1935;22(4):592-602.
22. Dayton RE, Marco TJD, Swedlow D. Treatment of hypersensitive root surfaces with dental adhesive materials. J Periodontol. 1974;45(12):873-8.
23. Nordenvall K, Brännström M. In vivo resin impregnation of dentin fractures. Swed Dent J. 1979;4(5):177-82.
24. Prati C, Cervellati F, Sanasi V, Montebugnoli L. Treatment of cervical dentin hypersensitivity with resin adhesives: 4-week evaluation. Am J Dent. 2001;14(6):378-82.
25. Lorenzi R, Anselmi M, Opisso V. Dentin desensitizing effects of Gluma Alternate, Health-Dent Desensitizer and Scotchbond Multi-Purpose. Am J Dent. 1999;12(3):103-6.
26. Ferrari M, Cagidiaco M, Kugel G, Davidson C. Clinical evaluation of a one-bottle bonding system for desensitizing exposed roots. Am J Dent. 1999;12(5):243-9.
27. Tengrungsun T, Sangkla W. Comparative study in desensitizing efficacy using the GaAlAs laser and dentin bonding agent. J Dent. 2008;36(6):392-5.
28. Duran I, Sengun A. The long-term effectiveness of five current desensitizing products on cervical dentine sensitivity. J Oral Rehabil. 2004;31(4):351-6.
29. Giannini M, Makishi P, Ayres APA, Vermelho PM, Fronza BM, Nikaido T, et al. Self-etch adhesive systems: a literature review. Braz Dent J. 2015;26(1):3-10.
30. de Groot AC. Propolis: a review of properties, applications, chemical composition, contact allergy, and other adverse effects. Dermatitis. 2013;24(6):263-82.
31. Parolia A, Thomas MS, Kundabala M, Mohan M. Propolis and its potential uses in oral health. International Journal of Medicine and Medical Science. 2010;2(7):210-5.
32. Park YK, Alencar SM, Aguiar CL. Botanical origin and chemical composition of Brazilian propolis. J Agric Food Chem. 2002;50(9):2502-6.
33. Dodwad V, Kukreja BJ. Propolis mouthwash: A new beginning. J Indian Soc Periodontol. 2011;15(2):121.
34. Dobrowolski JW, Vohora S, Sharma K, Shah SA, Naqvi S, Dandiya P. Antibacterial, antifungal, antiamoebic, antiinflammatory and antipyretic studies on propolis bee products. J Ethnopharmacol. 1991;35(1):77-82.
35. Shabbir A, Rashid M, Tipu HN. Propolis, A Hope for the Future in Treating Resistant Periodontal Pathogens. Cureus. 2016;8(7).
36. Sales-Peres SHdC, Carvalho FNd, Marsicano JA, Mattos MC, Pereira JC, Forim MR, et al. Effect of propolis gel on the in vitro reduction of dentin permeability. J Appl Oral Sc. 2011;19(4):318-23.
37. Ikeno K, Ikeno T, Miyazawa C. Effects of propolis on dental caries in rats. Caries Res. 1991;25(5):347-51.
38. Park YK, Koo MH, Abreu JA, Ikegaki M, Cury JA, Rosalen PL. Antimicrobial activity of propolis on oral microorganisms. Curr Microbiol. 1998;36(1):24-8.
39. Bretz WA, Chiego D, Marcucci M, Cunha I, Custódio A, Schneider L. Preliminary report on the effects of propolis on wound healing in the dental pulp. Zeitschrift für Naturforschung C. 1998;53(11-12):1045-8.

40. Chen C, Parolia A, Pau A, Celerino de Moraes Porto I. Comparative evaluation of the effectiveness of desensitizing agents in dentine tubule occlusion using scanning electron microscopy. Aust Dent J. 2015;60(1):65-72.
41. Almas K, Mahmoud A, Dahlan A. A comparative study of propolis and saline application on human dentin. A SEM study. Indian J Dent Res. 2000;12(1):21-7.
42. Hongal S, Torwane NA, Goel P, Chandrashekar B. The effect of 30% ethanolic extract of Indian propolis on replica of human dentin compared against commercially available desensitizing agent: A methodological SEM study in vitro. Pharmacognosy Res. 2014;6(2):113.
43. Madhavan S, Nayak M, Shenoy A, Shetty R, Prasad K. Dentinal hypersensitivity: A comparative clinical evaluation of CPP-ACP F, sodium fluoride, propolis, and placebo. J Conserv Dent. 2012;15(4):315.
44. Torwane NA, Hongal S, Goel P, BR C, Jain M, Saxena E, et al. Effect of two desensitizing agents in reducing dentin hypersensitivity: an in-vivo comparative clinical trial. J Clin Diagn Res. 2013;7(9):2042.
45. Mehta P, Vimala N, Mandke L. An insight into dentin desensitizing agents-In vivo study. Indian J Dent Res. 2013;24(5):571.
46. Purra AR, Mushtaq M, Acharya SR, Saraswati V. A comparative evaluation of propolis and 5.0% potassium nitrate as a dentine desensitizer: A clinical study. J Indian Soc Periodontol. 2014;18(4):466.
47. Torwane NA, Hongal S, Goel P, Chandrashekar B, Jain M, Saxena E. A clinical efficacy of 30% ethenolic extract of Indian propolis and Recaldent TM in management of dentinal hypersensitivity: A comparative randomized clinical trial. Eur J Dent. 2013;7(4):461.
48. Hussain RA-H, Dannan A, Al-Ahmad MN. Propolis Treatment for Dental Sensitivity after Tooth Bleaching. Imp J of Inter Res. 2017;2(5).
49. Schiff T, Delgado E, Zhang Y, Cummins D, DeVizio W, Mateo L. Clinical evaluation of the efficacy of an in-office desensitizing paste containing 8% arginine and calcium carbonate in providing instant and lasting relief of dentin hypersensitivity. Am J Dent. 2009;22(SI A):8A-15A.
50. Löe H. The gingival index, the plaque index and the retention index systems. J Periodontol. 1967;38(6 Part II):610-6.
51. Greene JC, Vermillion JR. The oral hygiene index: a method for classifying oral hygiene status. The Journal of the American Dental Association. 1960;61(2):172-9.
52. Carlsson AM. Assessment of chronic pain. I. Aspects of the reliability and validity of the visual analogue scale. Pain. 1983;16(1):87-101.

APPENDIX-I

CONSENT FORM

Research Title: A Comparative Evaluation of the Effect of Propolis and Dentine Bonding Agent in Reducing Dentin Hypersensitivity: An in-vivo Randomized Clinical Trial.

1. **Introduction of Principal Investigator:** Dr. Ather Akber, Lecturer & MSc.DS trainee in Department of Periodontology at Dow International Dental College (DIDC), DUHS.
2. **Information about Research:** This experimental study is being conducted to compare the efficacy of Propolis and Dentin Bonding Agent in reducing Dentin Hypersensitivity.
3. **Research Procedure:** The procedure involves routine scaling and root debridement under strict sterilization and disinfection protocol. After that dentin bonding agent or propolis will be applied to the patients and follow-up examination will be carried out immediately, after 7 days, 15 days and 30 days. You will pay for the routine Scaling and root planing charges to the hospital. You will be provided with a kit containing toothbrush and toothpaste during a time of study period
4. **Possible Risks and benefits:** There are no known risks associated with any of the materials being used in this research. This study will help us to device a method to treat patients having dentin hypersensitivity.
5. **Rights of the participant**: Participants are empowered to withdraw from the study at any time during the study time period and that there will be no penalties upon withdrawal. The level of care would not be affected if the participant decides to withdraw from the study.
6. **Confidentiality:** All the data and personal information obtained from the participants will be kept confidential.
7. **Contact Info:** Dr. Ather Akber. Department of Periodontology, Dow International Dental College (Defense Campus), Karachi. Further details may be sought by calling on 0333-3311550 between 9am-3pm.

You are welcome to contact the investigator if you have any questions.

Declaration of consent: I confirm that I _____understand the information which has been provided to me. I also understand that my participation is voluntary, and that I can withdraw from the study at any time without giving any reasons. I have also been assured that my medical care will not be affected by my withdrawal from the study.

Signature/ Thumb Impression of the participant:_____ Signature of witness:_____

Signature of Principal Investigator: _____ Date:_____

APPENDIX-II

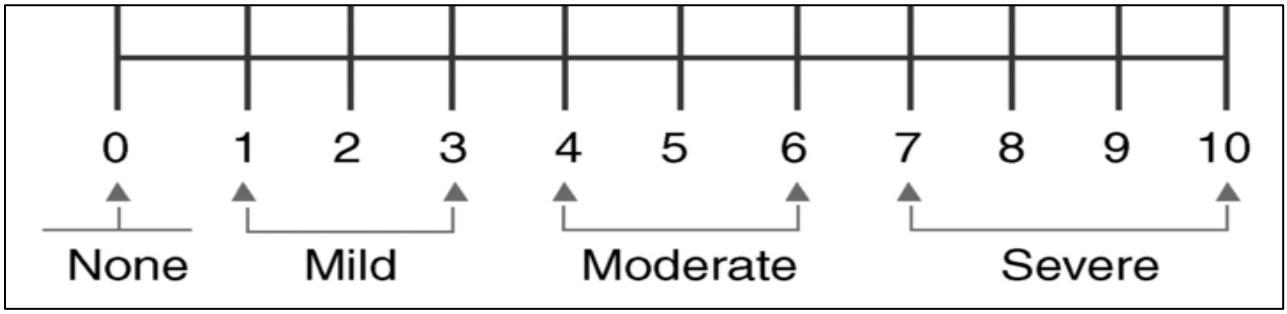
Date: _____ Form no: _____ Envelop: _____

Patients Name: _____ Age: _____ Sex: _____

Address: _____

Contact No. : _____ Occupation: _____

VAS



Schiff Cold Air Sensitivity Scale

0 = Subject does not respond to air stimulus

1 = Subject responds to air stimulus but does not request discontinuation of stimulus

2 = Subject responds to air stimulus and requests discontinuation or moves from stimulus

3 = Subject responds to air stimulus, considers stimulus to be painful and requests discontinuation of stimulus

	VAS	SCASS
Day 0 (Before Application)		
Day 0(Immediately after application)		
Day 7		
Day 15		
Day 30		