

Management of dentine hypersensitivity through Propolis – A Scoping Review

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Systematic Review

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Abstract

Objective: To evaluate the effect of propolis (a natural herb) against dentine hypersensitivity and to compare their effect with the controls.

Methodology: Two databases were selected and searched for the relevant articles published up to 2019. Clinical trials involving propolis with other desensitizing agents and comparing it with controls were included involving patients that possess dentine hypersensitivity along with the extracted teeth. Nine clinical trials from 1999 to 2019 met the criteria involving 169 patients who had sensitivity and 214 extracted teeth were included in this scoping review.

Results: Propolis was found to have a better desensitizing results than the controls, except Recaldent™ which showed better results than Propolis.

Conclusion: Our results support the assertion that propolis is a good option which occludes the dentinal tubules and can relieve the symptoms of dentine hypersensitivity. However more clinical trials and high quality studies are needed to confirm its results in a better way.

Introduction

Dental hypersensitivity is a clinical condition that often causes a person to seek dental treatment. Tooth contains three layers, the hardest one enamel, beneath enamel lies the dentin followed by pulp. When dentine is exposed to the external environment of the oral cavity, a severe short term pain occurs in response to certain stimuli. This condition not only causes acute pain and discomfort to the patient but it also restrains the person from eating and drinking due to which he or she seeks immediate dental care [1]. Various terms has been used to identify dental hypersensitivity such as cervical, dental hypersensitivity but 'Dentine Hypersensitivity' is used more because of its familiarity among dental health care professionals [2].

Factors leading to hypersensitivity

There are numbers of factors which causes dentine hypersensitivity such as loss of enamel, abrasion, abfraction, gingival recession etc. **(Table 1)** [3]. For dentine hypersensitivity to occur, the dentine needs to be exposed due to enamel loss or recession of the gingiva. Once it is exposed, the dentinal tubules will become unattached and any stimuli either hot or cold will commence fluid movement within those tubules by initiating the mechano receptors in the dentine pulp complex [2].

Accepted Theory of Dentine Hypersensitivity:

The Hydrodynamic theory for Reactive Dentin was first suggested by Brannstrom [4]. This hypothesis is the most generally known principle of DH. The hypothesis was suggested based on the flow of the fluid within the dental tubules. The hypothesis suggests that tubules are open between dental surfaces exposed to the atmosphere and pulp [5].

It is assumed that DH is formed as a consequence of fluid movement inside the dental tubules, which is further attributed to thermal and physical shifts, or as a consequence of the development of osmotic stimulus near the exposed dentin. Fluid action activates the baroreceptor and contributes to synaptic discharge. The mechanism is referred to as the hydrodynamic principle of pain. Cooling, heating, evaporation and hypertonic chemical stimulation allow the dental fluid to move out from the dentin pulp complex and allow intensified discomfort [6].

Trends in the management of Dentine Hypersensitivity:

Many materials and desensitizing agents have been used in the past and is being used presently for the management of hypersensitivity such as nitrates like potassium and silver, fluorides like strontium, stannous and sodium, many bioactive glasses, adhesive sealers and a homeopathic resin which is Propolis [7].

Role of Propolis in Dentistry:

Propolis have been widely used in the field of dentistry since many years. It a substance which is a resin extracted from the bee hives and it possess anti-bacterial, anti-inflammatory, anti-oxidant properties. Though it has many uses in dentistry such as healing of the wounds, medium for avulsed tooth, irrigating solution etc. [8], but our aim is to review the management of dentine hypersensitivity via the use of Propolis.

Research Question

Based on the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines [9], a specific question was constructed. The addressed focused question was “What is the future use of Propolis in the management of Dentine Hypersensitivity?”

Methods

The general hunt for the literature was carried out using PubMed and Medline as a source using the following entries: Propolis (n=2514), dentine hypersensitivity (n= 2491) Propolis and dentistry (n =302) **(Prisma Flow Chart, Figure 1)** [9]. A MeSH (Medical Subjects heading) search strategy didn't return any article. The following MeSH terms were used (Propolis and dentistry, Propolis and dentine Hypersensitivity) which gave zero results. Articles between 1999 and 2019 were searched manually. Dental books and journals were also searched. Words like dentine hypersensitivity, propolis were used for the search. The full text was reviewed whether there were inadequate evidence to render a reasonable conclusion based on abstracts. A structured and logical approach to literature search was used to identify the relevant papers based on Propolis implications in reducing dentine hypersensitivity.

Inclusion Criteria:

1. PubMed and Medline as databases

2. Clinical trials or Randomized Control trials
3. Articles having keywords dentine hypersensitivity or Propolis in their keywords or title were used.

Exclusion Criteria:

1. Articles published before 1999 were excluded
2. Cross sectional, Reviews and other designated studies were excluded

Quality of Assessment: The quality of assessment was evaluated using Evidence Based Medicine. Overall the quality level was dependent on type of study conducted i.e. clinical trials (**Table 2**).

Results

Our Search identified 9 records from 1999 to 2019 reporting clinical data (**Prisma flow chart Figure 1**) [9]. This review analyzed the published articles on the effectiveness of propolis in the treatment of dentine hypersensitivity. Out of 9 studies, four studies were in vivo involving 169 participants (Mahmoud et al [10], Madhavan et al [13], Torwane et al [14], Purra et al [16]) and 5 studies were in vitro involving 214 extracted teeth involving dentine disks (Almas et al [11], Sales et al [12], Hongal et al [15], Chen et al [17], Kripal et al [18]). One study by Torwane et al [14] showed Ricaldent (™) to be better than Propolis while remaining 8 studies proved propolis to be a better option in reducing dentine hypersensitivity.

Discussion

The Characteristics of the reported studies are mentioned in the **Table 3**. Mahmoud et al [10] assessed the results of efficacy of propolis on 26 female subjects from Saudi Arabia King Saud University. He also evaluated the degree of satisfaction among participants after its use. The study concluded for a period of four weeks. During this four weeks' time, participants were followed twice, 1: after one week and second time at the end of the study time. The base line results were satisfactory. Up to 85 % of the females were satisfied with the results and it was found that propolis had remarkable effects on hypersensitivity during that research period.

Almas et al [11] obtained 24 recently removed premolar teeth which were acquired from the Oral and Maxillofacial Surgery Section, King Saud University, Riyadh. Out of 48 dentin disk specimens, 24 specimens were handled with propolis and saline. They were classified into 4 groups, i.e.: (1) no material usage (control); (2) treatment with propolis for 60 seconds; (3) treatment with propolis for 120 seconds; and (4) saline treatment for 60 seconds. All specimens were primed for electron microscopy scanning and analyzed in SEM. Dental tubular occlusion persisted in all three propolis-treated dentin classes for 120 seconds. In occluding dental tubules, the propolis was stronger than saline.

Sales et al [12] estimated the efficacy of two propolis gels, fluoride gel and potassium oxalate in limiting the hydraulic conductance of dentin. For this purpose the researchers obtained 36 extracted teeth dentine discs and were divided into four treatment groups. Group 1 with 10% propolis gel, Group 2 with 30% propolis gel, Group 3 with 3% potassium oxalate and Group 4 with fluoride gel of 1.23%. SEM analysis was done to observe the occluding capacity of the four groups. Propolis gel was found to be occluding the tubules partially.

Madhavan et al [13] estimated the outcome of three desensitizer's i.e. CCP-ACPF, sodium fluoride and propolis and placebo was used as a control group to combat hypersensitivity. One hundred and twenty participants were evenly split into four classes with written informed consent to engage in this 3-month research. Demographic information, along with medical and dental records, were collected at the first screening session. In this analysis, each participant was provided with one of the four desensitizing items in compliance with the manufacturer's instructions. Pre-and post-treatment tests were performed on the average, seventh day, fifteenth day, twenty eighth day, sixtieth day, and observations were reported by the same investigator. The final evaluation was reported on the 90th day without any medication. The mean hypersensitivity values of the teeth handled with the study group declined over a span of three months relative to the control group. Overall, propolis was the overall winner in managing the hypersensitivity and that the CPP-ACPF was the least effective.

To test the effectiveness of propolis, Torwane et al [14] included 73 teeth from 13 individuals from Central Jail, Bhopal with at least three dentinally hypersensitive teeth was assigned randomly among three care groups. Group A comprised of 30% propolis, Group B with Recaldent and Group C with sterile water. Their baseline scores were recorded. Each group received intervention on first, seventh, fourteenth and twenty first day in a row and after every order their scores were registered. The results found out that Propolis and Recaldent causes a large drop in the sensitivity.

Hongal et al [15] assessed the potential of 30% ethanolic extract of propolis in blocking dental tubules. Thirty Extracted third molars were utilized and stored in 10% formalin. A section was obtained from each sample and was polished. All the specimen were divided into three treatment groups. Test groups consists of propolis and GC tooth mousse and a control group. SEM analysis was done to see the extent of occlusion. GC tooth mousse created crystal like deposits to occlude the tubules while propolis fabricated a thin layer over the occluding surface, hence propolis was successful in occluding uniformly.

Purra et al [16] evaluated the effectiveness of propolis for the treatment of dentine hypersensitivity. For this purpose he and his colleagues recruited participants aged between 20-40 years possessing sensitivity and willing to engage in this research for 3 months. Ten patients meeting the above criteria were included and teeth chosen for analysis were canine, bicuspid and tricuspid. Every patient was administered with Propolis saturated ethanol solution, 5% potassium nitrate and purified water. For the application of the agent and re-evaluation the patients were retrieved at the seventh day, 2 weeks and 4 weeks. The last re-evaluation of patients was done 3 months following the first application. The findings between the Propolis group and the potassium nitrate group revealed little substantial change in the immediate post-

treatment period; but at the end of the first week and the second week the findings were substantial. A contrast between the groups once again revealed no noticeable gap at 4 weeks and 3 months' time. It was concluded that in relieving hypersensitivity, Propolis was more successful than 5 percent potassium nitrate, which had an immediate lasting effect.

To evaluate the efficacy of propolis, Chen [17] and colleagues compared its effectiveness with arginine-calcium carbonate and calcium sodium phosphosilicate. To achieve this, 80 dentine disks were created with thickness of 1.0 (+ -) 0.1 mm. enamel was removed so that dentine is exposed. These discs were then polished to obtain an even surface and then were placed in distilled water so that abrasive is removed. Etchant was applied so that tubules may open up. After etching, these were soaked in saline for SEM analysis. The discs were randomly divided into four groups. 20 disks treated with propolis, 20 with arginine calcium carbonate, 20 with calcium sodium phosphosilicate and 20 in control (saline) group. It was found out that Propolis treated discs obstructed more tubules than the counter groups.

Kripal et al [18] conducted a study in the department of periodontology, Rajarajeshwari Dental College on 20 freshly extracted teeth which were free from any decay and were not root canal treated earlier. These teeth have been processed in formalin and used within one month after they have been pulled out. Crowns were sliced with a diamond blade, opposite to the long axis of the base, producing dentin disks from the mid-coronal dentin. The twenty disks were divided into two groups half of them in the test group and half of them were included in the control group. Each disk were handled with phosphoric acid as etchant accompanied by 30 seconds wash with water. The disks in the research group were painted with propolis varnish with a help of a thin brush and processed for 10 minutes prior washing with water. Control group disks were embedded in saline and the disks of both classes were exposed to a SEM examination. The results were significant and there was a substantial decline in the mean amount of accessible tubules in Group I disks, which was about 61.75 per cent. No decrease was found in the mean amount of free tubules in Group II. This research demonstrated the potential of propolis as a natural treatment modality for dental hypersensitivity.

Conclusion

Though a limited number of clinical trials have been done on propolis to see its effect on dental hypersensitivity, yet the results were fruitful and propolis was found to be almost successful but this adhesive resin is still under investigation that will certainly encourage the production of innovative health care products [19]. In this way various advantages of propolis will be identified which will enable its use in different oral treatment modalities [20]. Despite recent advances in today's era there have been limited investment and insufficient information regarding the production of natural products and limited clinical trials have been done to evaluate the efficiency of these products [21]. Though there are issues which limits the use of propolis in the field of dentistry such as variation in its antibacterial activity [22], other issues related to its processing and dose regulation which has greatly reduced its application [23].

The review present here exemplified that propolis is effectual in occluding the dentinal tubules thus reducing the hypersensitivity and it has opened the gate for researchers to deepen their knowledge regarding natural product like propolis.

Research regarding natural products has expanded in the recent years in the quest for innovative healthcare products. Herbal treatment is commonly and generally embraced with outstanding recognition among dental practitioners and patients. In this way, several natural goods have been produced and marketed by dental companies, backed by relevant laboratory and clinical trials and enhanced quality assurance. While the literature indicates a small amount of studies utilizing propolis, the assessment by researchers has increased, demonstrating that it is a material of considerable importance in the various areas of dentistry. Natural products and conventional medicines pose incomparable advantages due to their remarkable versatility in terms of chemical compositions and biological processes, which enable them to be used for the production of new drugs. Some of the problems mentioned in this literature review do need to be discussed, albeit with positive outcomes, despite that some of them do need clinical evaluation. Throughout this context, propolis remains an important research field given its use in biomedical and dental fields.

Declarations

Ethics approval and Consent to Participate:

Not Applicable

Consent for Publication:

Not applicable in this section.

Availability of Data & Materials:

Not Applicable

Competing Interests:

The authors declare that they have no competing interests in this section

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Author contributions:

Conceptualization, Writing – Original draft Preparation. **Syed Kashif Abrar:** Methodology. **Saad Uddin Siddiqui:** Validation, Writing – review and editing **Asad Allana:** Writing – Original draft

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Tables

Table 1. Factors associated with dentine hypersensitivity (Chanbanski and Gillam) ³.

· Loss of enamel
· Denudation of cementum
· Gingival recession
· Abrasion
· Attrition
· Abfraction
· Erosion
· Malposed tooth
· Thinning, fenestrations
· Periodontal disease
· Periodontal surgery, restorative treatment
· Patient habits

Table 2. Level of evidence

Level of evidence	Author, date and reference
1b	Mahmoud et al, 1999 ¹⁰
1b	Almas et al, 2001 ¹¹
1b	Sales et al, 2011 ¹²
1b	Madhavan et al, 2012 ¹³
1b	Torwane et al, 2013 ¹⁴
1b	Hongal et al, 2014 ¹⁵
1b	Purra et al, 2014 ¹⁶
1b	Chen et al, 2015 ¹⁷
1b	Kripal et al, 2019 ¹⁸

Table 3. Characteristics of the studies

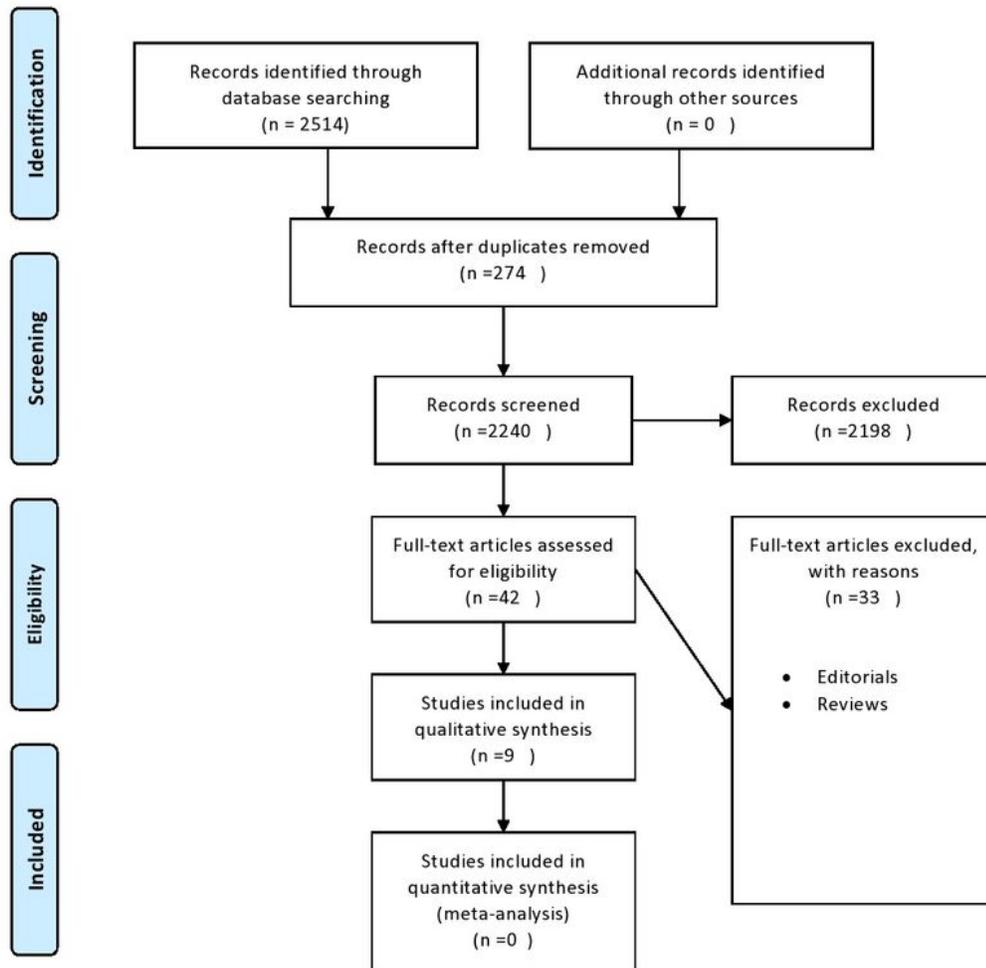
Author of the Article	Type of Article	Key points	Limitations
Mahmoud et al ¹⁰	Clinical trial	<ul style="list-style-type: none"> · First of its kind study done on Saudi females. · Propolis had significant effect on dental hypersensitivity 	<ul style="list-style-type: none"> · Small sample size · Full text not available online
Almas et al ¹¹	Clinical trial	<ul style="list-style-type: none"> · 24 extracted premolars used for checking the hypersensitivity. · Propolis was more effective than saline 	<ul style="list-style-type: none"> · Small size of sample teeth · Full text not available
Sales et al ¹²	Clinical trial	Propolis as compared to smear layer partially occluded the dentinal tubules.	None
Madhavan et al ¹³	Clinical trial	Propolis has been shown to be the most successful in managing dental hypersensitivity and CPP-ACPF has been shown to be the least effective.	<ul style="list-style-type: none"> · Long-term experiments and repeated applications of desensitizing agents are required. · Control groups should be well designed so as to get accurate results
Torwane et al ¹⁴	Clinical trial	Both 30% Indian propolis and the Recaldent TM reported a substantial decrease in DH	While the study size was determined to satisfy the goals of the present report, more clinical trials with a greater number of participants are required to determine the long-term results of propolis.
Hongal et al ¹⁵	Clinical trial	GC tooth mousse facilitated the occlusion of the tubules through crystal-like compounds. While the propolis formed a thin, smooth coating over the dentin surface.	The research is a one-period and observational that is unable to show the preservation of precipitate content such that more long-term analyses are needed.
Purra et al ¹⁶	Clinical trial	Propolis was more successful than 5% potassium nitrate in minimizing dental hypersensitivity and had an immediate and lasting effect.	None
Chen et al ¹⁷	Clinical trial	Following acid challenge, disks treated with propolis caused more occlusion than others.	As the present research was an in vitro trial, only minimal elements of the normal oral condition could be replicated. Which involve saliva, accumulated pellicles, action of the oral musculature and a brushing condition

			that may influence the effectiveness of the procedure.
Kripal et al 18	Clinical trial	This research demonstrated the potential of Propolis as a natural treatment modality for Dentine hypersensitivity	<ul style="list-style-type: none"> · Oral cavity conditions in vivo could not be replicated. · The absence of acid challenge to monitor the occlusion of the dental tubules following exposure to acid also leads to one of the shortcomings of the analysis.

Figures



PRISMA 2009 Flow Diagram ⁹



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Figure 1

The PRISMA diagram details our search and selection process applied during the overview.