European Journal of Dental and Oral Health
www.ejdent.org

Dentin Hypersensitivity Management Using Herbal Products: A Systematic Review

Zafeiria Mavrogiannidou, Genovefa Tsompani, Menelaos Anastasopoulos, Androniki Nasta, Stefania Poirazi, and Aikaterini Georgiadou

ABSTRACT

***Introduction*: Dentin hypersensitivity is a common and clinically significant issue, that many clinicians come across. There is currently a variety of available treatments. Over the past years, the use of herbal products in the medical and dental field has increased. The aim of this systematic review was to assess if the use of herbal products is more effective than conventional products, which are currently being used, in the management of dentin hypersensitivity.**

Methods: A systematic electronic search was performed in MEDLINE-PubMed, Scopus, and Web of Science up to December 2022. The quality of studies was assessed using the Risk of Bias tool version 2.

***Results*: A total of 2325 publications were identified, and 10 studies fulfilled all the inclusion criteria. Only randomized controlled trials addressed the management of dentin hypersensitivity using herbal oral products, while fulfilling the inclusion criteria.**

***Conclusion*: Within the limitations of this review, it was concluded that herbal products may not provide superior benefits reducing the symptoms of dentin hypersensitivity when compared with conventional products. Future studies, properly designed, are needed to determine the safety and efficacy of herbal products.**

Keywords: Dentin hypersensitivity, herbal products, natural products, sensitive teeth.

Published Online: April 10, 2023

ISSN: 2684-4443

DOI :10.24018/ejdent.2023.4.2.247

Z. Mavrogiannidou
School of Dentistry, Aristotle University of Thessaloniki, Greece. (e-mail: feniamavrogiannidou@gmail.com)
G. Tsompani*
School of Dentistry, Aristotle University of Thessaloniki, Greece. (e-mail: vefatso@gmail.com)
M. Anastasopoulos
School of Dentistry, Aristotle University of Thessaloniki, Greece. (e-mail: mene.anastas@gmail.com)
A. Nasta
School of Dentistry, Aristotle University of Thessaloniki, Greece. (e-mail: androniki.nasta@gmail.com)
S. Poirazi
School of Dentistry, Aristotle University of Thessaloniki, Greece. (e-mail: stefaniapoirazi@gmail.com)
A. Georgiadou
School of Dentistry, Aristotle University of Thessaloniki, Greece. (e-mail: kellygeorgiadou@yahoo.gr)

****Corresponding Author***

I. Introduction

Dentin hypersensitivity (DH) is a clinically significant issue, commonly seen in everyday practice. It is characterized by short and acute pain, that is not related to other dental pathologies, and which is a result of exposed dentin [1]. The average prevalence of DH discussed among studies is 33.5%, with the majority of patients being from specialty practices [2]. In addition, DH seems to affect more female than male patients, although the percentage tends to be statistically insignificant [3], [4]. All age groups can be affected, but the number of patients experiencing DH is higher in younger people. The reason for that may be the diet of younger people that is more acidic and results in tooth wear, as well as the development of secondary dentin in older people [5].

The etiology is not yet clear, and many theories have been suggested [6]. To this day, the most prominent and accepted theory is the hydrodynamic theory proposed by [7]. This theory proposes that because of stimuli, such as thermal, tactile, or chemical, the fluid flow within the dentinal tubules of exposed dentin is altered, thus stimulating the A-δ fibers. Consequently, the acute and short pain characterized as DH is triggered.

Dentin hypersensitivity may sometimes affect a patient's quality of everyday life [2]. However, patients often do not perceive DH as an important problem, and therefore do not seek treatment [8]. Moreover, the available treatments as well as the respected scientific evidence vary, consequently posing a challenge for the clinician when choosing the appropriate therapy [9]. Treatment options include in-office treatment, and/or at-home treatment. The most frequent used are local chemical or physical agents applied by dental professionals in-office or by patients at-home [6]. There is no gold-standard, and a big variety of options have demonstrated positive results regardless of their mechanism of action [10]. Among the most effective agents used are glass ionomer cements, potassium nitrate agents, arginine agents and the use of Laser [10].

Nowadays, the use of herbal products in medicine, and subsequently in the dental field has increased [11]. Several studies have shown the efficacy of natural and herbal products in caries detection, management of DH, management of gingival inflammation, and more [12], [13].

At the same time questions have been raised regarding the safety of these products, as well as the quality of the studies highlighting their efficacy [14]. The aim of this systematic review was to assess the clinical efficacy of herbal products in the management of dentin hypersensitivity.

II. Materials and Method

This systematic review was conducted in agreement with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [15]. A protocol agreed by all authors was developed beforehand in accordance with the PRISMA-P guidelines [16]. The protocol was registered in advance on Open Science Framework with the following Registration DOI: https://doi.org/10.17605/OSF.IO/RPV57.

A. P.I.C.O. Question

The following focused question was formulated in accordance with the PICO (Population, Intervention, Comparison, Outcome) format: "In adult patients experiencing dentin hypersensitivity, is the use of herbal oral products equally/less effective compared with other conventional products?"

Population: Adult human subjects >18 years old experiencing Dentin Hypersensitivity

Intervention: Use of herbal oral products

Comparison: Use of non-herbal oral products, or placebo

Outcome: Clinical Results (improvement, disappearance of symptoms measured using at least two stimuli)

B. Literature Search

A systematic electronic search was conducted and MEDLINE-PubMed, Scopus, and Web of Science databases were searched up to November 2022 to identify eligible studies. The keywords used were "(herb* OR natural OR organic) AND (dentin sensitivity OR dentin hypersensitivity OR dentine sensitivity OR dentine hypersensitivity OR dentinal sensitivity OR dentinal hypersensitivity OR sensitive tooth OR sensitive teeth)". A search for grey literature was also performed using GreyNet International (http://greynet.org) and Grey Literature Report (http://www.greylit.org). References of all included articles were hand-search utilizing the snowball technique to include any relevant publications. No restriction regarding the language was applied. A follow-up search was performed in December 2022 for additional articles.

C. Inclusion Criteria

All randomized and non-randomized clinical trials that examine the effect of herbal oral products compared with non-herbal conventional products or placebo on adult patients >18 years old. Included studies must report the use of more than one stimulus to evaluate dentin hypersensitivity, as it has been suggested in the literature to produce more accurate results [1]. Animal studies, in vitro studies, presentation abstracts, letters to the editor and studies including patients after periodontal or other types of oral surgery were excluded.

D. Study Selection

Six reviewers (MA, GT, ZM, AN, SP, KG) independently performed the study selection after conducting the search. During the first stage, each reviewer assessed the eligibility of the literature results based on their titles and abstracts. On the second stage a full text analysis was conducted. To avoid excluding any potentially relevant studies, all publications providing limited information were included for full-text analysis. All reviewers individually conducted a search for grey literature and evaluated the references of the included studies. Any potential disagreement was resolved with discussion.

E. Data Extraction

The six reviewers independently performed a data extraction for each included study. A predetermined template was used to retrieve general information about the study (year, country, study design, funding), information about the treatment (number of participants, age/gender of participants, treatment groups), and information about the clinical findings (post-treatment evaluation, follow-up, conclusions).

F. Risk of Bias

To assess quality of the included studies, version 2 of the Cochrane risk-of-bias tool for randomized trials (RoB 2) was utilized [17]. Studies were assessed for bias arising from the randomization process, bias due to deviations from the intended interventions, bias due to missing outcome data, bias in measurement of the outcome, and bias in selection of the reported result. The assessment was performed by four independent reviewers (MA, GT, ZM, AN) and any disagreement was resolved with discussion.

III. Results

An overview of the selection process is presented in Fig. 1. The initial search returned a total of 2325 publications. After duplicate records were removed (n=365), the remaining publications (n=1960) were assessed for eligibility based on their titles and abstracts. Of those, 16 publications were sought for retrieval and subsequent full-text analysis. An extra (n=1) publication was identified from the references of these 16 publications. After full-text analysis, 10 studies fulfilled the inclusion criteria and were subsequently included in this systematic review [18]-[27]. Out of the seven excluded publications, three were excluded because they did not fulfill the age criteria for inclusion [28]-[30]. Three studies were excluded because the included products were non-herbal [31]-[33]. The last study was excluded because only one stimulus was used for the evaluation of post-treatment dentin hypersensitivity [34]. Inter-reviewer agreement was calculated, using Cohen's kappa, to be k=0.94 for the first round and k=0.98 for the second round.

The extracted characteristics of the studies are shown on Table I. Nine of the studies were conducted in India and one in Thailand. Included studies were published between 2012 and 2021. Four of the studies were reported as randomized controlled trial, three were reported as double- blind randomized controlled trial, one was reported as a triple-blind randomized controlled trial, one as a single-blind randomized parallel clinical design and one as a double-blind parallel-group comparison study.

European Journal of Dental and Oral Health
www.ejdent.org

TABLE I: CHARACTERISTICS OF THE INCLUDED STUDIES

Study	Year	Country	Study Design	Number of participants	Age/Gender	Groups	Post-treatment evaluation	Follow-up	Conclusions	Funding
[18]	2013	India	Double-blind randomized controlled trial	13	Mean age 37 /All Males	A. Propolis B. casein phosphopeptide-amorphous calcium phosphate C. Placebo	Tactile, evaporative stimulus, Verbal Analogue Scale	1, 2, 3 weeks	Propolis and casein phosphopeptide-amorphous calcium phosphate were effective, but propolis was less	No
[19]	2020	India	Double-blind randomized controlled trial	13	20-40/Males and Females	A. Propolis B. Light-cured ornocer-based desensitizer C. Placebo	Tactile, evaporative stimulus, Visual Analogue Scale	1, 2, 3 weeks, 1, 2 months	Propolis and Light-cured ornocer-based desensitizer were effective, but the second was more efficient and longer-lasting	No
[20]	2013	India	Triple-blind randomized controlled trial	60	25-60/ 33 Males, 27 Females	A. Herbal dentifrice B. Placebo	Evaporative, thermal stimulus, Visual Analogue Scale	6, 12 weeks	Herbal dentifrice showed better results	Yes
[21]	2017	India	Randomized controlled trial	45	20-50/Not mentioned	A. Calcium sodium phosphosilicate dentifrice B. Arginine containing dentifrice C. Herbal dentifrice	Tactile, evaporative stimulus, Visual Analogue Scale	2, 4 weeks	All groups showed improvement in symptoms, Calcium phosphosilicate dentifrice showed the better reduction	No
[22]	2016	India	Single-blind, randomized, parallel clinical design	160	20-60/93 Males, 67 Females	A. Potassium nitrate dentisfrice B. Calcium sodium phosphor-silicate dentifrice C. Strontium chloride dentifrice D. Herbal dentifrice	Tactile, evaporative, thermal stimulus, Visual Analogue Scale	2 weeks, 1, 2 months	All groups showed improvement in symptoms, Calcium phosphor-silicate dentifrice showed the best reduction	No (received dentifrices for free)
[23]	2021	India	Randomized controlled trial	40	20-40/Not mentioned	A. Herbal dentifrice 1 B. Herbal dentifrice 2	Tactile, evaporative stimulus, Visual Analogue Scale	2, 4 weeks	Both groups showed similar results in reduction of symptoms	No
[24]	2019	India	Double-blind randomized controlled trial	45	18-50/Not mentioned	A. Potassium salt dentifrice B. Herbal dentifrice C. Arginine containing dentifrice	Tactile, evaporative stimulus, Visual Analogue Scale	1, 2, 4 weeks	All groups were effective in reducing the symptoms. Arginine containing dentifrice was the most effective, followed by the herbal	No
[25]	2012	India	Randomized controlled trial	120	20-40/Not mentioned	A. casein phosphopeptide-amorphous calcium phosphate B. Sodium fluoride C. Propolis D. Placebo	Tactile, evaporative stimulus, Visual Analogue Scale	1, 2 weeks, 1, 2, 3 months	Casein phosphopeptide-amorphous calcium phosphate , Sodium fluoride and Propolis were effective, Propolis was the most effective	No
[26]	2016	India	Randomized controlled trial	120	25-60/73 Males, 72 Females	A. Placebo B. Herbal dentifrice C. Non-herbal potassium nitrate dentifrice	Evaporative, thermal stimulus, Visual Analogue Scale	6, 12 weeks	The herbal dentifrice showed comparable results to the non-herbal potassium nitrate dentifrice, improving the symptoms	Yes
[27]	2019	Thailand	Double-blinded randomized parallel-group comparison study	90	20-65/ Not mentioned	A. Herbal dentifrice B. Potassium nitrate dentifrice C. Sodium monofluorophosphate dentifrice	Tactile, evaporative stimulus, Visual Analogue Scale	2, 4 weeks	The herbal dentifrice reduced symptoms to the same extent as did the synthetic desensitizing dentifrice.	Yes

.

European Journal of Dental and Oral Health
www.ejdent.org

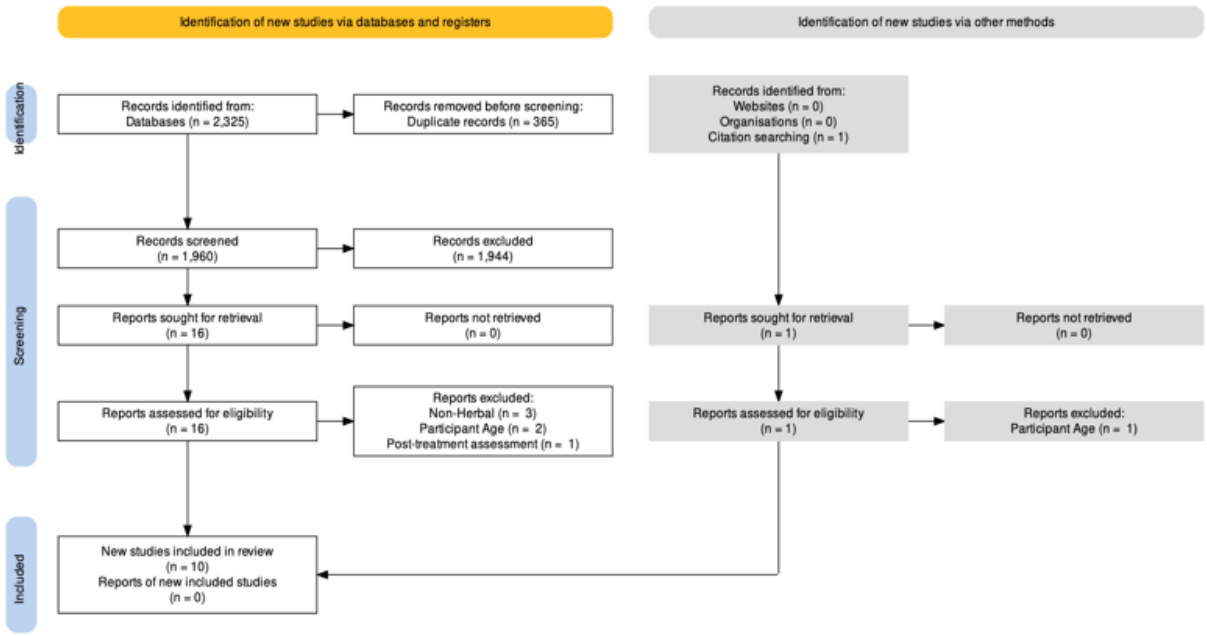

Fig. 1. Flowchart with an overview of the selection process.

Three studies mentioned having received funding, and the rest reported that they did not. However, one study that reported not having received any funding, mentioned that it received the products used for the study by a company. The number of study participants ranged from 13 to 160. Nine studies included both male and female participants, while in one study only male participants were included.

To evaluate the efficacy of the products, all studies used at least two stimuli and recorded the reaction of the patient using either a verbal analogue scale or a visual analogue scale. Six studies reported using tactile and evaporative stimuli, while recording the reaction using a visual analogue scale. Two studies reported using evaporative, and thermal stimuli and recorded the patient's reaction using a visual analogue scale. One study used tactile and evaporative stimuli, recording the patient's reaction using a visual analogue scale. One study used evaporative, thermal, and tactile stimuli, and recorded the patient's reaction using a visual analogue scale. All the included studies had follow-up checkups for patients. The follow-up times varied and ranged from four weeks, up until four months.

A variety of herbal oral products were used in the included studies that reported including:

- Propolis
- A dentifrice containing clove (Lavanga), spinach, Cinnamomum verum, and triphala
- A dentifrice containing calendula, azadirachta indica, staphysagria
- A dentifrice containing spinach (spinacia oleracea)
- A dentifrice containing Cyanthillium cinereum, Java tea, mangosteen peel, hydrocotyle plant, clinacanthus nutans, extracts of orange jasmine leaf, salvadora persica
- A dentifrice containing herbal extracts of Sphatika Bhasma and Kalmishora

All the included studies showed that the use of herbal products helped with the management of DH, by reducing the symptoms. However, when herbal products were compared with conventional products, almost all studies favored the use of conventional products. These studies also reported that conventional products were more effective, and sometimes with longer and faster action, in decreasing the symptoms of DH.

In one study the use of propolis was compared with casein phosphopeptide-amorphous calcium and a placebo. Even though both propolis and casein phosphopeptide-amorphus were effective, the results highlighted that the latter was more efficient. In another study, propolis was compared with a light-cured ornocer-based desensitizer as well as a placebo. Results showed that both the propolis as well as the light-cured ornocer desensitizer were both effective, but the second was more efficient with longer lasting results. However, in another study, propolis was compared with casein phosphopeptide-amorphous calcium, sodium fluoride and a placebo, and the results showed that propolis exhibited the most effective results.

Four studies examined the effects of an herbal dentifrice containing clove (Lavanga), spinach, Cinnamomum verum, and triphala. Out of those, one study compared it with a placebo group, and the results showed an improvement in symptoms when patients used it. Another study compared it with a calcium sodium phosphosilicate dentifrice, and a n arginine-containing dentifrice. All three groups proved to be effective, with the calcium sodium phosphosilicate dentifrice being the most effective. Another study compared this herbal dentifrice with another herbal dentifrice containing herbal extracts of Sphatika Bhasma and Kalmishora. Both groups showed similar effectiveness with no significant difference. Lastly, in another study, when compared with a potassium salt dentifrice and an arginine dentifrice, the dentifrice containing arginine showed the best efficacy. However, all groups exhibited improvement in symptoms.

One study compared a dentifrice containing calendula, azadirachta indica, staphysagria with another potassium nitrate dentifrice, a calcium sodium phosphosilicate dentifrice, and a strontium chloride dentifrice. All groups showed improvement in symptoms, and the calcium phosphor-silicate dentifrice showed the best reduction in symptoms.

In another study a dentifrice containing spinach (spinacia oleracea) was compared with a non-herbal potassium nitrate dentifrice and a placebo group. The herbal one showed comparable results to the non-herbal.

Lastly, another study compared an herbal dentifrice containing containing Cyanthillium cinereum, Java tea, mangosteen peel, hydrocotyle plant, clinacanthus nutans, extracts of orange jasmine leaf, salvadora persica with a potassium nitrate dentifrice and a sodium monofluorophosphate dentifrice one. The results exhibited the same level of efficacy between all groups.

The risk of bias assessment showed only two studies fulfilled the criteria in all domains and were assessed with a low risk of bias. The other eight studies were assessed with some concerns. The assessment in detail for all domains is shown in Fig. 2.

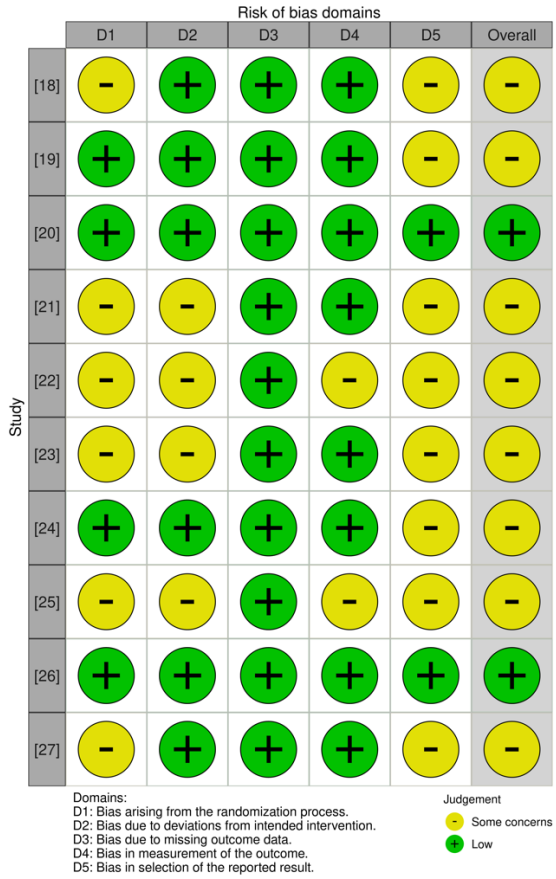

Fig. 2. Overview of the Risk of Bias assessment using the Risk of Bias Version 2 tool.

IV. Discussion

Even though DH can influence patients' everyday lives, many people do not seek help. In general, male patients have lower attendance rates than women [35]. Men tend to delay their visit to medical professionals, to try and not appear effeminate [36]. In addition, the topic of DH is sometimes confusing even for clinicians, regarding the diagnosis, causes and management [9]. Nowadays, even though management protocols have been suggested, there is still a plethora of available treatments [37]. The use of herbal medicine in the medical field has increased over the past years [38]. They have shown to be effective in the dental field, but not enough well-conducted studies have been performed [39], [40]. In this review, we examined the studies that evaluate the efficacy herbal products in the management of DH. Herbal products included in the studies were gels and dentifrices that reported containing: propolis, clove (Lavanga), spinach, Cinnamomum verum, and triphala, calendula, azadirachta indica, staphysagria, Cyanthillium cinereum, Java tea, mangosteen peel, hydrocotyle plant, clinacanthus nutans, extracts of orange jasmine leaf, salvadora persica, Sphatika Bhasma and Kalmishora. In studies where herbal products were compared with conventional medicine, herbal products showed to be effective in reducing the symptoms. However, in all but three studies, conventional medicine exhibited better efficacy. Out of these three studies, herbal products were equally effective to the conventional treatment in two, and in one they showed better results. When herbal products were compared with either a placebo or other herbal products, they exhibited reduction in the symptoms of DH. Even though herbal products are effective in managing DH, they are less, and sometimes way less, effective than conventional treatment options and do not achieve such long-lasting effects. An important note is that the bias assessment for the studies that indicated herbal products were more effective showed some concerns. Moreover, their safety is not well researched yet. Unexpected side effects from the use of herbal products have been reported in the literature. Among these are allergic reactions, renal failure, and drug interaction [38]. In some countries, certain herbal products may even be introduced to the market without proper safety evaluation [41]. Not all included studies included a placebo group. While some people argue that ethically a placebo group should not be present, others suggest that a placebo group is essential to establish a baseline against which active treatments are measured [42]. This can be considered a limitation of this review. In addition, most studies did not mention if the patients were instructed not to use any other desensitizing agents at home. These include desensitizing toothpastes, as well as other products that may have interfered with the study. Furthermore, there was a variability in the reporting, study protocols, and interventions among the studies included in this review. The detailed composition of the herbal products used was also not described in full detail in the studies. These are also limitations of this present review. Reporting guidelines, such as CONSORT, exist to minimize the bias and produce uniform reporting [43]. Lastly, it is of paramount importance to highlight that the toxicity and possible side effects of herbal products should be thoroughly investigated. Future well-constructed studies are needed to properly determine the long-lasting and side effects, as well as the efficacy of herbal products. These future studies should provide uniform reporting, utilizing reporting guidelines.

V. Conclusion

Within the limitations of this study, it is concluded that the use of herbal oral products may not provide any supplementary benefits when compared to conventional products. Evidence suggests that herbal products mostly have similar or lower efficacy in the management of dentin

hypersensitivity. In addition, there is a lack of studies regarding the safety of herbal oral products, and their side effects are still unknown. Future properly conducted studies are needed to further establish their efficacy and safety. Extrapolation of the results of this systematic review should be treated with caution, because of the low number of available studies, as well as their quality.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] 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(11): 808-813.
[2] Favaro Zeola L, Soares PV, Cunha-Cruz J. Prevalence of dentin hypersensitivity: Systematic review and meta-analysis. *J Dent.* 2019; 81: 1-6.
[3] Amarasena N, Spencer J, Ou Y, Brennan D. Dentine hypersensitivity in a private practice patient population in Australia. *J Oral Rehabil.* 2011; 38(1): 52-60.
[4] Taani DQ, Awartani F. Prevalence and distribution of dentin hypersensitivity and plaque in a dental hospital population. *Quintessence Int.* 2001; 32(5): 372-376.
[5] Splieth CH, Tachou A. Epidemiology of dentin hypersensitivity. *Clin Oral Investig.* 2013; 17 Suppl 1(Suppl 1): S3-8.
[6] Bartold PM. Dentinal hypersensitivity: a review. *Aust Dent J.* 2006; 51(3): 212-218.
[7] Brännström M. A hydrodynamic mechanism in the transmission of pain producing stimuli through the dentine. In: Anderson DJ, editor. Sensory mechanisms in dentine. Oxford: Pergamon Press; 1963; p. 73–9.
[8] Gillam DG, Bulman JS, Eijkman MA, Newman HN. Dentists' perceptions of dentine hypersensitivity and knowledge of its treatment. *J Oral Rehabil.* 2002; 29(3): 219-225.
[9] Canadian Advisory Board on Dentin Hypersensitivity. Consensus-based recommendations for the diagnosis and management of dentin hypersensitivity. *J Can Dent Assoc.* 2003; 69(4): 221-226.
[10] Marto CM, Baptista Paula A, Nunes T, Pimenta M, Abrantes AM, Pires AS, et al. Evaluation of the efficacy of dentin hypersensitivity treatments-A systematic review and follow-up analysis. *J Oral Rehabil.* 2019; 46(10): 952-990.
[11] Zhang J, Wider B, Shang H, Li X, Ernst E. Quality of herbal medicines: challenges and solutions. *Complement Ther Med.* 2012; 20(1-2): 100-106.
[12] Abbasi AJ, Mohammadi F, Bayat M, Gema SM, Ghadirian H, Seifi H, et al. Applications of Propolis in Dentistry: A Review. *Ethiop J Health Sci.* 2018; 28(4): 505-512.
[13] Pistorius A, Willershausen B, Steinmeier EM, Kreislert M. Efficacy of subgingival irrigation using herbal extracts on gingival inflammation. *J Periodontol.* 2003; 74(5): 616-22.
[14] Ernst E. Herbal medicines-they are popular, but are they also safe? *Eur J Clin Pharmacol.* 2006; 62(1): 1-2.
[15] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021; 372: n71.
[16] Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev.* 2015; 4(1): 1.
[17] Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ.* 2019; 366: l4898.
[18] Torwane NA, Hongal S, Goel P, Chandrashekar BR, Jain M, Saxena E. A clinical efficacy of 30% ethenolic extract of Indian propolis and Recaldent™ in management of dentinal hypersensitivity: A comparative randomized clinical trial. *Eur J Dent.* 2013; 7(4): 461-468.
[19] Maity S, Priyadharshini V, Basavaraju S. A comparative evaluation of propolis and light-cured ormocer-based desensitizer in reducing dentin hypersensitivity. *J Indian Soc Periodontol.* 2020; 24(5): 441-446.
[20] Kumari M, Naik SB, Rao NS, Martande SS, Pradeep AR. Clinical efficacy of a herbal dentifrice on dentinal hypersensitivity : a randomized controlled clinical trial. *Aust Dent J.* 2013; 58(4): 483-90.
[21] Bansal D, Mahajan M. Comparative Evaluation of Effectiveness of Three Desensitizing Tooth Pastes for Relief in the Dentinal Hypersensitivity. *Contemp Clin Dent.* 2017; 8(2): 195-199.
[22] Majji P, Murthy KR. Clinical efficacy of four interventions in the reduction of dentinal hypersensitivity: A 2-month study. *Indian J Dent Res.* 2016; 27(5): 477-482.
[23] Bansal D, Mahajan M. Comparative evaluation of the effectiveness of the two herbal desensitizing toothpastes in the relief of dentinal hypersensitivity. *J Int Clin Dent Res Organ.* 2021; 13: 42-47.
[24] Kar PP, Shaikh ZA, Hiremath AM, Vikneshan M. Comparison of the effectiveness of three different desensitizing toothpastes in reducing dentin hypersensitivity: A 4-week clinical study. *J Conserv Dent.* 2019; 22(2): 181-184.
[25] 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): 315-318.
[26] Kumari M, Naik SB, Martande SS, Pradeep AR, Singh P. Comparative efficacy of a herbal and a non-herbal dentifrice on dentinal hypersensitivity: a randomized, controlled clinical trial. *J Investig Clin Dent.* 2016; 7(1): 46-52.
[27] Vajrabhaya L, Sappayatosok K, Kulthanaamondhita P, Korsuwannawong S, Sirikururat P. Desensitizing Efficacy of a Herbal Toothpaste: A Clinical Study. *World J Dent.* 2019; 10(6): 408-412.
[28] Mahmoud AS, Almas K, Dahlan AA. The effect of propolis on dentinal hypersensitivity and level of satisfaction among patients from a university hospital Riyadh, Saudi Arabia. *Indian J Dent Res.* 1999; 10(4): 130-137.
[29] Wang H, Zhao X, Ji P. Effects of atraditional chinese medicine based desensitizing gel on dentin hypersensitivity. *African Journal of Traditional, Complementary and Alternative Medicines*. 2015; 12(2): 103-113.
[30] Abdullah Al Qahtani W, Sandeepa NC, Khalid Abdullah E, Mohammed Mousa Y, Abdulhade Ganem A, et al. A clinical study comparing the efficacy of sesame oil with desensitizing tooth paste in reducing dentinal hypersensitivity: a randomized controlled trial. *Int J Dent.* 2020; 2020: 6410102.
[31] Camilotti V, Zilly J, Busato Pdo M, Nassar CA, Nassar PO. Desensitizing treatments for dentin hypersensitivity: a randomized, split-mouth clinical trial. *Braz Oral Res.* 2012; 26(3): 263-268.
[32] Gillam DG, Newman HN, Davies EH, Bulman JS. Clinical efficacy of a low abrasive dentifrice for the relief of cervical dentinal hypersensitivity. *J Clin Periodontol.* 1992; 19(3): 197-201.
[33] Hoang-Dao BT, Hoang-Tu H, Tran-Thi NN, Koubi G, Camps J, About I. Clinical efficiency of a natural resin fluoride varnish (Shellac F) in reducing dentin hypersensitivity. *J Oral Rehabil.* 2009; 36(2): 124-31.
[34] 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): 466-471.
[35] Nuttall NM, Bradnock G, White D, Morris J, Nunn J. Dental attendance in 1998 and implications for the future. *Br Dent J.* 2001; 190(4): 177-82.
[36] Noone JH, Stephens C. Men, masculine identities, and health care utilisation. *Sociol Health Illn.* 2008; 30(5): 711-725.
[37] Orchardson R, Gillam DG. Managing dentin hypersensitivity. *J Am Dent Assoc.* 2006; 137(7): 990-8.
[38] Boullata JI, Nace AM. Safety issues with herbal medicine. *Pharmacotherapy*. 2000; 20(3): 257-69.
[39] Ekor M. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. *Front Pharmacol.* 2014; 4: 177.
[40] Laleman I, Teughels W. Novel natural product-based oral topical rinses and toothpastes to prevent periodontal diseases. *Periodontol 2000.* 2020; 84(1): 102-123.
[41] Ernst E. The efficacy of herbal medicine--an overview. *Fundam Clin Pharmacol.* 2005; 19(4): 405-409.
[42] Miller FG, Brody H. What makes placebo-controlled trials unethical? *Am J Bioeth.* 2002; 2(2): 3-9.
[43] Kwakkenbos L, Imran M, McCall SJ, McCord KA, Fröbert O, Hemkens LG, et al. CONSORT extension for the reporting of randomised controlled trials conducted using cohorts and routinely collected data (CONSORT-ROUTINE): checklist with explanation and elaboration. *BMJ*. 2021; 373: n857.