



EMERGING ROLE OF HERBAL AGENTS IN VITAL PULP THERAPY

Dentistry

Dr. Shubhangi Mittal

Post Graduate Second Year, Department Of Conservative Dentistry & Endodontics
Genesis Institute Of Dental Science & Research, Ferozepur, Punjab

Dr. Rudhra Koul

Senior Lecturer, Department Of Conservative Dentistry & Endodontics Genesis Institute
Of Dental Science & Research, Ferozepur, Punjab.

Sushant Mittal

Third Year B.D.S Student Dasmesh Institute Of Research And Dental Sciences, Faridkot,
Punjab.

ABSTRACT

Herbs have been used since time immemorial to cure various diseases due to their anti-microbial properties. In endodontics, plants and their extracts can be used as irrigants, intracanal medicaments, pulp capping agents and storage media for avulsed teeth. The use of ethnopharmacology is staging a comeback and an era of herbal renaissance is being revolutionized in the field of vital pulp therapy all over the globe. This article provides an insight into the herbal agents that can provide clinicians a road map to use safer alternatives to chemical agents used in endodontics.

KEYWORDS

Herbal Agents; Vital pulp therapy; Endodontics

INTRODUCTION

Vital pulp therapy (VPT) aims towards preserving the vitality and function of the dental pulp after injury resulting from trauma, caries or restorative procedures. VPT's status has seen many "peaks and troughs" in the recent years, with Rebel's 1922 observation that the "exposed pulp was a doomed organ" still resonating with some to this day.[1] Recent position statements from the American Association of Endodontists and the European Society of Endodontology concluded that 'pre-treatment diagnosis of irreversible pulpitis is not necessarily an indication for pulpectomy', heralding a new era for minimally invasive VPT in mature permanent teeth.[2,3] VPT encompasses a wide range of procedures like direct pulp capping, indirect pulp capping, partial pulpotomy etc that focus on minimal intervention and maintenance of healthy pulp tissue.

The use of herbal agents for treating diseases is known as "Phytotherapy or Phytomedicine or Ethnopharmacology". The concept of phytotherapy was brought to light by French physician Henri Leclerc in 1913 and published "Handbook of Phytotherapy" in 1922.[4] Herbal medicine is defined by the World Health Organization as a plant originated preparation or material that includes processed or raw components from one or more plants that have medicinal properties[5]. Various agents like calcium hydroxide, formocresol, ZOE, MTA etc have been used for VPT but due to some disadvantages like cytotoxicity, discolouration, long setting time, difficulty in handling and high solubility the shift is towards use of herbal agents. The various advantages of herbal products are its lack of microbial tolerance, biocompatibility, ease of use and low cost.

Herbal Agents Used For Vpt Are:

1. Propolis

Made by the honeybee, Propolis is one of the bee products that means the "city's guardian". In some references it has been called as Russian Penicillin, it is a potent antimicrobial and anti inflammatory agent.[6,7] A study by Ahangari et al provides evidence that Propolis has advantages over calcium hydroxide as a capping agent in vital pulp therapy and this material induces the production of a tubular and high-quality dentin.[8]

It has been shown that propolis is more effective in vital pulp therapy than calcium hydroxide as it leads to no pulpal inflammation and necrosis and results in induction of high-quality tubular dentin production.[9] The reason for the effectiveness of propolis in decreasing pulpal sensitivity primarily is due to the proper sealing of dentinal tubules through its appropriate resin and adhesion properties, as well as its anti-inflammatory effect which reduces pulpal inflammation.[10] Anti-inflammatory chemical compounds that exist in propolis include a wide range of acetin, apigenin, caffeic acid phenethyl ester, chrysin, caffeic acid, cinnamic acid, ferulic acid, galangin, gallic acid, isoferulic acid, protocatechuic acid and coumaric acid.[11] One study showed that flavonoid in propolis may inhibit

bacterial growth in the VPT by reducing host responses to bacterial antigens.[12] A direct pulp capping procedure with propolis containing flavonoids, in contrast to propolis without flavonoid and zinc oxide, delay the pulp inflammation and stimulate dentin repair. Propolis has the ability to inhibit osteoclastic activity or resorption, and induce high quality tubular dentin in VPT.[13]

2. Nigella Sativa (NS)

Also known as called black cumin or black seed, is native to the south and southwest Asia. A study searched for a new capping medicament in dentistry to replace formocresol because of its reported side effects. The results showed that NS specimens histologically revealed mild to moderate vasodilatation with few inflammatory cells and formation of a continuous odontoblastic layer in comparison to formocresol.[14]

Faour et al showed that NS caused less severe inflammatory reactions than calcium hydroxide and it was concluded that NS paste can be as a direct pulp capping material as it led to a faster hard tissue formation than calcium hydroxide with less inflammation. The NS extracts demonstrated analgesic, anti-inflammatory and antibacterial action has led to its usage as a pulpotomy agent.[15]

3. Aloe barbadensis (Aloe Vera)

Research shows that when aloe vera comes into contact with pulp tissue, it stimulates dentin creation by promoting the proliferation and differentiation of pulp cells into odontoblast-like cells in addition to mineral deposition. As a result, it creates a dentine barrier onto the pulp tissue that has been exposed. This success rate may be due to aloe vera's biocompatibility and strong antibacterial and anti-inflammatory qualities that help in reparative dentin creation.[16] Treatment of human papillary cells with aloe vera can result in the expression of dentin saliva protein, vascular endothelial growth factor, type I collagen, alkaline phosphatase, BMP-2 and BMP-4.[17,18] Aloe vera, when applied directly to exposed rat pulpal tissue, demonstrates good biocompatibility and promotes the formation of tertiary dentin bridges. These properties are due to various bioactive components, such as beta-sitosterol, glycoproteins, and polysaccharides. These components promote cell proliferation, angiogenesis and wound healing.[19]

4. Allium Sativum (Garlic)

Allicin is an active ingredient of garlic, which has the potential to destroy the cell wall and membrane of *Actinobacillus actinomycetemcomitans* (*A.actinomycetemcomitans*), *Fusobacterium nucleatum* (*F.nucleatum*) and various root canal pathogens. *Allium sativum* oil showed comparable results to formocresol when used in conjunction with aloe vera as a pulpotomy medicament.[20]

5. Honey

Honey has a solid reputation among natural goods in the literature due to its medicinal properties. It is antibacterial and promotes the healing

of wounds. This natural product was evaluated by Reddy et al. as a pulpotomy agent on both the clinical and radiological fronts.[21] Another important aspect of honey's effectiveness as a pulpotomy agent is the higher rate of anti-inflammatory qualities brought on by its acidic existence. Honey has been shown to significantly increase the release of certain cytokines from monocytes, including tumor necrosis factor-alpha, interleukin (IL)-1, and IL-6, which have been found to be crucial for tissue repair and healing.[22]

6. Ankaferd Blood Stopper (ABS)

ABS is an herbal extract that was created from five different plants: *Thymus vulgaris*, *Glycyrrhiza glabra*, *Vitis vinifera*, *Alpinia officinarum*, and *Urtica dioica*. These plants have various effects on the endothelium, blood cells, angiogenesis, cell proliferation, vascular dynamics and act as cell mediators. As soon as ABS is applied, a protein network that is enclosed forms, providing focal areas for crucial erythrocyte aggregation. ABS pulpotomy tests have shown a progress rate between 89 and 100 percent.[22]

7. Apple Cider Vinegar (ACV)

ACV is a biocompatible product with antimicrobial properties and good efficacy in smear layer removal makes it suitable agent in VPT without detrimental impact on dentin interraderial calcium content.[23] ACV produced improved pain management. This could be explained by the anti-inflammatory properties of malic acid, which was found in apple vinegar and had been linked to a decrease in pain. ACV yielded non significantly successful outcome but substantially improved pain alleviation; therefore ACV generated a positive result on postoperative pain for VPT of mature permanent teeth with carious exposure.[24]

8. Galla Chinensis Extract (GCE)

A natural traditional Chinese medicine mainly consisting of tannic and gallic acids. A study revealed that the GCE showed thicker dentin bridge formation in pulp capping period with outcome evaluated that chemical make-up of the GCE have been theorized to be calcium ion carriers, providing the demineralized hard tissue structure with calcium ions from the remineralization solution.[25] Gallic acid is considered as the main effective component of GCE that enhance the calcium ion deposition on the demineralized tissue. Additionally, an investigation examining the shape and structure of hydroxyapatite crystals with gallic acid treatment recommended that gallic acid may influence the process of the hydroxyapatite formation. Appearance of osteodentine formation within the pulp tissue resulted in intra pulpal calcification so that GCE is a promising direct pulp capping material.[26]

9. Baicalein

It is a widely acceptable and effective pulp capping agent. Its effects are better than calcium hydroxide with direct pulp capping procedures. In a study, it was demonstrated that baicalein promoted odontoblastic differentiation and angiogenesis of human dental pulp cells by activating the BMP and catenin signal pathways.[27]

10. Thymus

Thymus vulgaris is a perennial sub-shrub with small grey or green leaves. It is native to the Mediterranean region and is cultivated in many countries. *Thymus vulgaris* extracts when they are added to zinc oxide powder as vital pulpotomy medicaments.[28] The use of propolis and thymus extracts for vital pulp treatment of teeth was promising as alternatives to formocresol. Different concentrations of propolis and thymus extracts should be studied for these natural materials with a longer follow-up period. Thymus offers good clinical and radiographical results when compared with formocresol.[29]

CONCLUSION

With the era of minimal invasive dentistry the trend of traditional root canal treatment is diversifying to the concept of vital pulp therapy approaches. The complete shift of focus aimed at maintaining the vitality of the pulp. With the emergence of herbal dentistry and research in safer plant based alternatives the goal of vital pulp therapy seems predictable and the phyto-genic alternatives for benefaction of the dental pulpal tissue. However, there is growing concern over the use of such products in dentistry. There are few reports in the literature about the negative effects of these natural products some of these include allergies, gastrointestinal and central nervous system effects.

REFERENCES

- Stanley, H.R., 1989. Pulp capping: conserving the dental pulp—can it be done? Is it worth it?. *Oral Surgery, Oral Medicine, Oral Pathology*, 68(5), pp.628-639.

- Hirschberg, C.S., Bogen, G., Galicia, J.C., Lemon, R.R., Peters, O.A., Ruparel, N.B., Tay, F.R. and Witherspoon, D.E., 2021. AAE position statement on vital pulp therapy. *J Endod*, 47(9), pp.1340-4.
- European Society of Endodontology (ESE) developed by: Duncan, H.F., Galler, K.M., Tomson, P.L., Simon, S., El Karim, I., Kundzina, R., Krastl, G., Dammaschke, T., Fransson, H. and Markvart, M., 2019. European Society of Endodontology position statement: Management of deep caries and the exposed pulp. *International Endodontic Journal*, 52(7), pp.923-934.
- Ferreira, T.S., Moreira, C.Z., Cária, N.Z., Victoriano, G., Silva Jr, W.F. and Magalhães, J.C., 2014. Phytotherapy: an introduction to its history, use and application. *Revista Brasileira de Plantas Mediciniais*, 16, pp.290-298.
- Murray, P.E., Farber, R.M., Namerow, K.N., Kuttler, S. and Garcia-Godoy, F., 2008. Evaluation of *Morinda citrifolia* as an endodontic irrigant. *Journal of endodontics*, 34(1), pp.66-70.
- Gupta, S., Kundabala, M., Acharya, S.R. and Ballal, V., 2007. A comparative evaluation of the antibacterial efficacy of propolis, 3.0% sodium hypochlorite and 0.2% chlorhexidine gluconate against *enterococcus faecalis*-An in vitro study. *Endodontology*, 19(2), pp.31-38.
- Marcucci, M.C., 1995. Propolis: chemical composition, biological properties and therapeutic activity. *Apidologie*, 26(2), pp.83-99.
- Ahangari, Z., Naseri, M. and Vatandoost, F., 2018. Propolis: Chemical composition and its applications in endodontics. *Iranian endodontic journal*, 13(3), p.285.
- Ahangari Z., Mashhadiabbas F., Kashefnejad M., Mansouri Y., Effect of Propolis on Osteoclasts. 7th IADR Iranian Division Annual Meeting Tehran 2012.
- Parolia, A., Kundabala, M., Rao, N.N., Acharya, S.R., Agrawal, P., Mohan, M. and Thomas, M., 2010. A comparative histological analysis of human pulp following direct pulp capping with Propolis, mineral trioxide aggregate and Dycal. *Australian dental journal*, 55(1), pp.59-64.
- Toreti, V.C., Sato, H.H., Pastore, G.M. and Park, Y.K., 2013. Recent progress of propolis for its biological and chemical compositions and its botanical origin. *Evidence Based Complementary and Alternative Medicine*, 2013(1), p.697390.
- Burdock, G.A., 1998. Review of the biological properties and toxicity of bee propolis (propolis). *Food and Chemical toxicology*, 36(4), pp.347-363.
- Sabir, A., Tabbu, C.R., Agustino, P. and Sosroseno, W., 2005. Histological analysis of rat dental pulp tissue capped with propolis. *Journal of oral science*, 47(3), pp.135-138.
- AlAttas, S.A., Fat'Heya, M.Z. and Turkistany, S.A., 2016. *Nigella sativa* and its active constituent thymoquinone in oral health. *Saudi medical journal*, 37(3), p.235.
- Faour, E., Laflouf, M., Manadili, A., Ateek, A., Alkhoul, M. and Al-Nerabieh, Z., 2021. A Histological evaluation of *Nigella Sativa* as a direct pulp capping material (An In-Vivo Study). *Int. J Dent. Oral. Sci.*, 8, pp.3393-3401.
- Abirami K., Ramkumar H., Senthil D. Clinical and Radiographic Assessment of the Efficacy of Formocresol, Allium sativum Oil, and Aloe barbadensis Gel as Pulpotomy Medicaments in Primary Molars: A Randomized Controlled Trial. *Int. J Clin Pediatr Dent*. 2020; 13: 518-522.
- Jittapiromsak, N., Sahawat, D., Banlunara, W., Sangvanich, P. and Thunyakitpisal, P., 2010. Acemannan, an extracted product from Aloe vera, stimulates dental pulp cell proliferation, differentiation, mineralization, and dentin formation. *Tissue Engineering Part A*, 16(6), pp.1997-2006.
- Boonyayagul, S., Banlunara, W., Sangvanich, P. and Thunyakitpisal, P., 2014. Effect of acemannan, an extracted polysaccharide from Aloe vera, on BMSCs proliferation, differentiation, extracellular matrix synthesis, mineralization, and bone formation in a tooth extraction model. *Odontology*, 102, pp.310-317.
- Gala-Garcia, A., Teixeira, K.I.R., Mendes, L.L., Sobrinho, A.P.R., Santos, V.R. and Cortes, M.E., 2008. Effect of aloe vera on rat pulp tissue. *Pharmaceutical Biology*, 46(5), pp.302-308.
- Kahvand, M., Mehran, M., Haghgo, R. and Faghihi, T., 2019. Clinical and radiographic evaluation of Allium sativum oil (garlic oil) in comparison with formocresol in primary molar pulpotomy. *Journal of International Society of Preventive and Community Dentistry*, 9(4), pp.390-395.
- Reddy, G.A., Sridevi, E., Sankar, A.S., Pranitha, K., Gowd, M.P. and Vinay, C., 2017. Endodontic treatment of chronically infected primary teeth using triple antibiotic paste: An in vivo study. *Journal of Conservative Dentistry and Endodontics*, 20(6), pp.405-410.
- Molan, P.C., 2006. The evidence supporting the use of honey as a wound dressing. *The international journal of lower extremity wounds*, 5(1), pp.40-54.
- Tekin, B. and Demirkaya, K., 2020. Natural irrigation solutions in endodontics.
- Bagchi, D., Preuss, H.G. and Swaroop, A. eds., 2015. *Nutraceuticals and functional foods in human health and disease prevention*. CRC Press.
- Cheng, L., Li, J., Hao, Y. and Zhou, X., 2010. Effect of compounds of *Galla chinensis* on remineralization of enamel surface in vitro. *Archives of oral biology*, 55(6), pp.435-440.
- Huang, X.L., Liu, M.D., Li, J.Y., Zhou, X.D. and Ten Cate, J.M., 2012. Chemical composition of *Galla chinensis* extract and the effect of its main component (s) on the prevention of enamel demineralization in vitro. *International journal of oral science*, 4(3), pp.146-151.
- Lee, S.-I., Kim, S.-Y., Park, K.-R., Kim, E.-C. Baicalein promotes angiogenesis and odontoblastic differentiation via the BMP and Wnt pathways in human dental pulp cells. *Am. J. Chin. Med.* 2016, 44, 1457-1472.
- Roby MHH, Sarhan MA, Selim KA-H, Khalel KI. Evaluation of antioxidant activity, total phenols and phenolic compounds in thyme (*Thymus vulgaris* L.), sage (*Salvia officinalis* L.), and marjoram (*Origanum majorana* L.) extracts. *Ind Crops Prod* 2013; 43: 827-831.
- Mejare I, Mejare B. An in vitro study with various vehicles of diffusion of formocresol and its components. *Eur J Oral Sci* 1978; 86: 259-266.