

Relevance of the Phytochemicals in Aloe vera Barbadosis Miller (ABM) as Adjuvant Medicament in the Treatment of Acute Pulpitis

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Abstract

The gold standard treatment for carious teeth with symptomatic pulps is root canal therapy. Conservation treatment with permanent restorative materials and adjuvant lining medicaments are also often performed but this may be associated with a high incidence of recurring symptoms. In favour of root canal treatment protocol was the theory that increased pulpal pressure from inflammatory reaction causes strangulation of the apical vessels in the root because the tooth provides a rigid closed system. Nevertheless, this theory has been disproved by further experimental research findings. Furthermore, mechanical cleaning and sanitisation of the canals with chemical solutions was thought to effect a complete elimination of the virulent micro-organisms in the pulp-canals but current findings show that this technique does not fully accomplish this task. This is because some virulent microbes especially anaerobes have been found active in the root canals despite the oxygen-free environment. In addition, some other virulent microbes such as the gram negatives have been found quiescent in the canal-delta and they give problems in later years. These shortcomings and limitations in root canal treatment diminish its avowed value and this therefore, demands remedial techniques that will overcome the challenges. The phytochemicals in Aloe vera Barbadosis Miller (ABM) which we have tried in our practice as adjuvant Medicaments were found satisfactory and promising.

Key Words: Phytochemicals, Aloe vera barbadensis miller, Adjuvant medicament, Acute pulpitis

Introduction

The axiom that the best root treatment is healthy pulp [1] is an ideal situation which everyone would like to enjoy, but unfortunately this is often difficult to achieve throughout life. This is as a result of certain factors such as caries and trauma which adversely impact the structures and functions of the teeth by causing inflammation of pulp tissues. As a result of pulpitis, patients may present with excruciating and debilitating pain that pose serious challenge to dental surgeons during treatments. In such clinical conditions, root canal treatment is considered the gold standard. Arguably, this treatment protocol stemmed from the concept that increased pulpal pressure as a result of inflammatory reaction causes strangulation of the apical vessels because the tooth provides a rigid closed system [2]. This theory has since been disproved by researchers such as Mjor and Tronstad [3]. Moreover, mechanical and chemical processes of cleaning the canals with broaches, reamers, files and sanitising or antiseptic solutions followed by obturating with root canal sealants which were thought to eliminate all virulent micro-organisms in the canals do not hold sustainable proof. Current literature has reported recurrent infections with embarrassing symptoms in canal treated-roots even years after the root fillings. This has been explained to be due to late virulent activities of quiescent microbes that thrive even in oxygen-free environment [4]. The indication of vascular blood flow in the pulp tissues is a reliable way to accurately diagnose the histopathological status of a tooth but this requires Lasser doppler flowmetry [5]. Unfortunately, this facility is not readily available in many dental centres in developing economies including ours. As a result of this lack, clinical history, signs and symptoms presented by patients during visits are used in arriving at diagnoses.

In this paper, we present a report of prospective cohort study of 36 patients we treated for acute pulpitis in our dental

clinics with phytochemicals obtained from the pulp of ABM. These were conservation treatments as alternatives to root canal treatments. In the procedures, we aimed at encouraging pulp tissue regeneration, repair and healing of the odontoblasts in addition to elimination of pain, inflammation and infection [6,7].

Patients and Method

This is a prospective cohort study of 36 patients that were treated in our dental clinic within a period of two years. They comprised of 20 males and 16 females in the age range of between 19 and 33 years. All the patients had carious posterior teeth that were associated with pain which they variously described as sharp, throbbing or dull in character. Five of the patients reported inability to sleep at night due to spontaneous onset of pain, while 9 patients associated the onset of their pain with hot or cold drinks and food. Twenty two patients could not pin-point any stimulating factor to their symptoms. Biting the teeth together was not an initiating factor in any of the pain episodes. Peri-apical radiographs did not show apical luscency, and pulp vitality was elicited in all the patients. Before we commenced treatment each patient, signed informed consent forms after a detailed explanation of the treatment modalities to the patient was obtained. Management of patients adhered to the ethical guideline on the treatment of human subjects.

Clinical diagnosis of acute pulpitis was respectively made in all the patients. Routine oral preparation was done in each patient using antiseptics such as chlorhexidine gavage or 3% hydrogen peroxide solution followed with mouth bath with water before administering local anaesthetics and subsequent treatments. Cavity preparations to remove carious and necrotic tissues were done with rotary and ultrasonic instruments to prevent loss of healthy enamel/dentine tissues and to ensure clean removal of necrotic tissues. We used

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gauze and cotton wools to isolate the cavities from oral fluids and other contaminants. We did not apply rubber dam because we include endodontic instruments such as broaches, files, reamers which could inadvertently and easily slip down into the oro-pharynx and throat. The gauze and cotton wool balls satisfied the clinical needs in the procedures which included prevention of fluid and solid contaminants from seeping into the cavities. Suction machine was in application during each procedure to keep the cavities and the surgical environment conducive.

Before commencement of each procedure, the gel-sap liquid was obtained from the pulp of a fresh leaf of the ABM plant under optimal hygienic standard. A leaf was carefully teased out from the stem of the plant. This method prevents or drastically reduces sap loss which could easily occur by using a knife to slice the leaf out of the stem. The whole leaf was carefully and thoroughly cleaned with chlorhexidine solution under running water and then allowed to dry.

The intact surfaces of the leaf were next cleansed with 70% alcohol using cotton wools, avoiding contamination. A slice is made on the base of the leaf, close to its attachment to the stem to obtain the yellow sap into a sterile 5 millimeter stoppered bottle. Further up the leaf away from the base, the leaf is cut through and the gel from the pulp was scooped into the same bottle, and the covered. The phytochemical is kept away from direct sun light. The gel from the pulp would ooze out in the bottle, and with a pipette, the gel and sap were mixed before delivery into the cavities or onto the cotton wools.

The phytochemical was rubbed on each cavity floor using cotton pledget or pipette to deliver it. Another cotton pledget soaked in the ABM fluid but in this case carefully pressed free of dripping liquid was applied into the cavity floor. This wet cotton was aimed at establishing phytochemical-depot in the cavity from where the chemicals could leach into the pulp tissues without logging the cavity with excess gel-sap. Dry cotton wool was then applied onto the wet cotton layer to form a barrier between the phytochemicals on the cavity floor and the glass ionomer cement that served as temporary restorative material.

The patients were then asked to call back in six weeks time for review and possibly for permanent restoration. However a patient could come back earlier if any unpleasant symptom such as recurrent pain occurred.

Results

All the 36 patients reported back on the sixth week recall visit dates free of pain. Three patients reported that they felt apprehensive within the first forty eight hours with some mild discomfort. They claimed that the discomfort was after the effect of the local anaesthesia and that they had feared that their pre-treatment pain would recur after the effect of the local anaesthesia. But fortunately, the apprehensions and discomforts soon disappeared quietly without the anticipated aggravation.

All the treated teeth responded positive to nerve vitality tests after the six weeks. The ABM dressings were then removed and the teeth restored with bonding permanent

restorative materials. The patients were followed up till three years post-operatively, which was partly the time they stopped keeping appointments.

Discussion

The treatment modality often considered a gold standard by many clinicians in the treatment of acute pulpitis and necrotic pulps is root canal therapy. Conservation treatment with obtundent, cariostatic liners and permanent filling material are also occasionally done on inflamed pulps that have no necrotic tissues. The preference of root canal therapy to conservation treatment is because it was thought that attempts at salvaging the inflamed pulps with conservation treatment would be associated with unpleasant clinical outcome of at least recurrent symptoms. This theory of vascular strangulation has since been disproved through research. Damaged pulps have been reported to have the capacity to recover. Moreover, root canal therapy which was regarded as a gold standard treatment has recently been reported to be short of its desired goal of keeping microbe-free milieu in the canals. Some anaerobes are now found to thrive in the oxygen-free root canal environment while some other microbes may remain quiescent for some time. Also toxins released from the bacteria leach into both neighbouring and distant tissues in the body with a long time health hazards. Anthraquinone in the ABM is found to address these shortcomings.

The conventional adjuvant dressing and lining medicaments for pulps and cavities include calcium hydroxide paste and zinc oxide/eugenol cements. In spite of their professed tasks of providing insulation, calcific barrier over the pulp and dentine, and obtundent effect on the symptomatic pulp, these medicaments are associated with complications which distract on the usefulness attributed to them. Calcium hydroxide paste, for instance, is known to cause internal root resorption, while eugenol in zinc oxide/eugenol cement has been reported to cause contact dermatitis in children. Research in experimental animals has also shown that eugenol can be toxic to the liver and can cause testicular necrosis at certain high concentrations [8]. These adverse reactions have not been associated with ABM phytochemicals in any of the various clinical procedures in which they have been used [9-11]. In addition to the roles provided by the two conventional medicaments, ABM phytochemicals provide other important functions such as anti-inflammatory, analgesic, reparative and healing effects, and antibacterial, antiviral and antifungal effects [12,13].

In the series of patients we treated, apparently, inflammation was reversed, and pain abated by the bioactive ingredients contained in the plant extracts. Bradykinase, a peptidase enzyme found in the extracts, breaks down bradykinine which is an inflammatory substance that induces pain. This enzyme works in synergy with another substance, a glycoprotein hormone known as c-glycosyl chromone [14]. This hormone, c-glycosyl chrome, inhibits cyclooxygenase pathway in the formation of prostaglandin E2. Prostaglandin E2 is essential in inflammatory process and pain generation.

Further more, another phytochemical, alprogen, a glycoprotein, performs anti-inflammatory and anti-allergic activities by inhibiting calcium influx to mast cells. This

action prevents antigen-antibody mediated release of histamine and leukotrienes from mast cells [15]. These functions are shared by salicylic acid which is another phytochemical in the plant gel. This chemical is similar to acetyl salicylic acid which is an anti-inflammatory and analgesic pharmaceutical drug. The combined effects of all these phytochemicals unarguably effected the pain-free clinical outcome witnessed in all the patients at the sixth week recall-visits. The repair and regeneration of the damaged pulps were possibly effected by another group of phytochemicals. Gibberellin [16] has been reported to interact with growth factor receptors in tissue fibroblasts and stimulates their activity and proliferation, and this leads to collagen synthesis [16]. This hormone also stimulates angiogenesis in tissues, and this is cardinal in tissue regeneration. With collagen formation and subsequent calcification with minerals such as calcium and magnesium [5] which are available in the gel , calcific barrier was formed to seal off the pulp tissues.

In addition to the gibberellin, some complex polysaccharides, glucomannan and acemannan [17,18] contributed to the repair, regeneration and healing of the injured or damaged pulps [17,18]. These complex carbohydrates are transported direct to tissues through the process of pinocytosis. In the target tissues, they assist in repair and regeneration of damaged cells. This biological role was essential in repair and reactivation of the pulp tissues which could haveresulted to the good clinical outcome witnessed among the patients.

Sanitisation of the pulp tissue environment was enhanced by the antimicrobial effect of aloin and emodin which are anthraquinone components from the plant sap. They exercised antimicrobial activities against gram positive and gram negative bacteria such as streptococcus pyogens, streptococcus faecalis, pseudomonas aerogenosa and anaerobes and enveloped viruses [19].

Tissue penetration of the phytochemical ingredients into the pulp tissue was apparently facilitated by lignin which is a lipoprotein [12]. This constituent obtained from the gel has been used topically in cosmetic industries to enhance penetration of constituent ingredients deep through into many cell layers [12]. Lignin has the ability to penetrate deep through many cells and it carries other chemicals along with it. This effect could make the ingredients available where their functions and activities were needed.

The use of phytochemicals in Aloe vera Barbadensis Miller in the treatment of oral diseases has been in the increase over the last decade following their health benefits to man. The gel and sap are found to posses numerous valuable biochemical agents which posses anti-inflammatory, analgesic, tissue regenerative and repair properties. The gel and sap also contains anthraquinone which is anti-infective against a wide spectrum of micro-organisms.

Conclusion

Our results indicate that the prospects of the phytochemicals in Aloe vera Barbadensis Miller in addressing the challenges encountered in pulpitis, unsuccessful root canal treatment, loss of tooth vitality appear promising. It is our opinion that these phytochemicals should further be studied and evaluated to

ascertain their respective potency, dose related facts, as well as the effect and potency of the individual ingredients in their primary states, and also in synergy with other bioactive substances (phytochemicals) in the plant as we applied them in our procedures.

This might need clinical trials with control subjects to address such shortcoming which may associate this type of pilot study.

Funding

No fund was received from any institution or organization outside ours.

Competing interests

We have no personal or group interests in the outcome of this work. We also state that there is competing interest known to us.

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