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Editorial

"Cryotherapy"– A Panacea for Post-Operative Pain Following Endodontic Treatment

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The main rationale of endodontic treatment is to eliminate micro-organisms from the infected root canal system by an adequate chemo mechanical debridement followed by a three dimensional obturation to achieve a hermetic seal, thereby to provide a conducive environment for periradicular healing. However, even with the utmost care in performing a root canal therapy, some patients experience pain or flare ups following the treatment. This post-endodontic pain is an unpleasant yet unfortunately, a common sensation encountered in a clinical scenario which may affect the quality of patient-doctor relationship [1]. The incidence of this post endodontic pain (PEP) was reported to range from 3 - 58% [2]. Pak and White concluded that the prevalence of PEP was 40% at 24 hours, whereas it reduced to 11% at 1 week and it was most intense in the first six hours following a gradual decline after a week [3,4].

The various reasons attributing to PEP are many-fold which include the condition of the pulp and periradicular tissues, microbial factors, the effects of inflammatory chemical mediators, immune system mediated phenomena, cyclic nucleotide changes, patients' psychological factors, preoperative pain, gender, type of tooth involved, and changes in the local adaptation and the periapical tissue pressure [5,6]. In addition, inadequate root canal instrumentation, hyper-occlusion, failure to recognize additional/accessory canals, presence of periapical pathology, extrusion of apical debris, and apical patency during canal preparation also contribute to the occurrence of PEP [7]. Irritants affecting the periapical tissues that can evoke pain sensations include several irrigating solutions or medicaments employed during root canal therapy [5]. Whilst this pain may be due to an acute inflammatory response in the periradicular tissues, pain in itself is a poor indicator of pathology and is considered an unreliable predictor for long term success. Hence, the integral part of endodontic treatment must include prevention and management of this post endodontic pain.

However, this PEP can be prevented in clinical situations by adapting meticulous careful measures during the endodontic treatment procedure. Each clinical step of root canal therapy (RCT) must be done with utmost perfection, some examples include, accurate working length (WL) determination, proper cleaning and shaping (crown down technique) with adequate sequencing of instruments, optimum use and judicious selection of intracanal irrigants, and use of magnifying devices, such as dental loupes and endodontic microscopes [8,9]. The use of a negative apical pressure irrigation device can also result in a significant reduction of post endodontic pain levels in comparison to conventional needle irrigation [10]. Several other strategies which have been developed for PEP management include premedication with prophylactic analgesics and corticosteroids prior to endodontic treatment, administration of long-lasting anaesthesia, and occlusal reduction [11-15].

Cryotherapy is a long-standing therapeutic technique that has been frequently applied in sports injuries and surgical procedures for pain management and postoperative care in the field of medicine [16,17]. Cryotherapy has been reported to be effective at reducing oedema, pain, inflammation and recovery time with short-term applications in orthopaedic, abdominal, gynaecological and hernia operations [17-20]. The term cryotherapy is derived from the Greek word cryos, meaning "cold". Though, it refers to lowering or decreasing the tissue temperature for therapeutic purposes, cryotherapy actually does not imply implementing cold but rather extracting heat [21]. The magnitude of the change in temperature and biophysical alterations in the tissues depend upon the differences in the temperature of the object and the heat or cold application, exposure time, thermal conductivity of the tissues, and type of the heat or cold agents employed. The clinical implication of this type of therapy in human tissues causes changes in the host's local temperature [22].

The basic physiological responses following the application of either heat or cold are: i) increase or decrease in local blood flow, ii) stimulation or inhibition of neural receptors in the skin and

subcutaneous tissues, and iii) an increase or decrease in cellular metabolic activity [23]. Physiological and clinical evidence suggest that cold therapy, in different forms, may reduce musculo-skeletal pain, muscular spasm, connective tissue distension, nerve conductivity time, haemorrhage and inflammation [21,23]. According to Van't Hoff's law, cryotherapy causes vasoconstriction and slows down cellular metabolism by limiting biochemical reactions which minimize the degree of tissue damage, thereby reducing the oxygen demand of cells and limiting the production of free radicals in tissues [24,25]. Vasoconstriction produces antiedema effects, and pain reduction is achieved after temperature reduction because of blockade of the nerve endings resulted from cold application [26]. The intensity of the vasoconstriction effect reaches the highest value at a temperature of 15°C [26] and it has been reported that lowering the body temperature decreases peripheral nerve conduction, and in particular, when it reaches about 7°C there is complete deactivation of myelinated A-δ fibres whereas deactivation of non-myelinated C-fibre occurs at about 3°C, as proved by Franz and Iggo [27]. Also, changes in tissue pressure activates pain receptors called as thermoreceptors, i.e. temperature-sensitive nerve endings. Cryotherapy activates these thermoreceptors, thereby blocking nociception within the spinal cord [24]. Nociceptors are specialised nerve endings which are activated following a tissue injury. Therefore, the analgesic effect resulting from cryotherapy is mainly produced by a combination of a decreased release of inflammatory chemical mediators of pain and a slower conduction of neural pain signals.

In dentistry, cold application has been frequently employed for postoperative pain control following intraoral surgical procedures [28]. Though, mechanism of action and effectiveness of cryotherapy is well addressed in the literature [17,22], strong evidence to support its conclusions is lacking, besides standardisation of crucial factors such as the time period, duration, application mode and cold agent used. However, in recent years, few studies have attempted and reported the intracanal use of cryotherapy in endodontics to reduce post endodontic pain [29-31]. For instance, Vera., *et al*. (2016) reported in an in vitro study that, cold saline solution (2.5°C) when employed as a final irrigant for 5 mins, resulted in reduction of external root surface temperature by more than 10°C and maintained for 4 mins, which may be enough to produce a local anti-inflammatory effect in periradicular tissues [29]. But, the first clinical study on the effect of intracanal cryotherapy in endodontics was conducted by C Keskin., *et al*. (2016) who assessed the effect of 2.5°C cold saline irrigation as a final irrigant following biomechanical preparation of root canals on postoperative pain in patients with irreversible pulpitis and, reported that, there was a significant pain reduction levels when compared to that of a control group [30]. In this study, the authors compared the effect of intracanal cryotherapy by delivering the cold saline solution using conventional needle irrigation with side-vented 31 G NaviTip needle inserted 2 mm short from working length, during the root canal treatment of all patients. However, a recent clinical study by Al-Nahlawi., *et al*. (2016) revealed the effects of intracanal cryotherapy and negative irrigation technique (EndoVAc System) on post endodontic pain after vital single visit endodontic treatment [31]. According to the results of this significant study, intracanal cryotherapy along with negative pressure irrigation system reduced PEP and resulted in elimination of post endodontic pain clinically [31].

Hence, in light of these observations, intracanal cryotherapy can be considered as a simple, cost-effective, and non-toxic therapeutic treatment option for postoperative pain control in single visit RCT cases. However, numerous research studies should be conducted in the near future to investigate the possible benefits of this technique in the treatment of other pulpal and periradicular diseases. In addition, the investigation of inflammatory markers amongst patients subjected to intracanal cryotherapy might shed a further light on the action mechanism and the potential use of cryotherapy in endodontics [30].

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