

**Back to the roots with curcumin: A review of curcumin use in pediatric endodontics**

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**Abstract**

In order to find out a material with lesser side effects and one which can raise the chances of clinical success in complex anatomy of root canals of primary teeth, research in Pediatric Endodontics has veered towards a combination of natural substances along with previously established traditional materials like ZOE and Iodoform. A polyphenol namely Curcumin, known to possess antimicrobial, analgesic, antioxidant and immunomodulatory properties and extensively used in indigenous medicinal preparations in India and China, has gradually gained foothold in dentistry, specifically in pediatric endodontics. Tapped from rhizomes of

*Curcuma longa*, it's used for pulpotomy as well as an obturating material for primary teeth. To properly document the usage of Curcumin in the last ten years, a literature search was conducted using the online database and keywords. The results regarding the clinical as well as radiographic success of Curcumin, used as a standalone material or in conjunction with other materials, is recorded.

**Keywords:** Primary teeth, curcumin, pediatric endodontics, natural

**Introduction**

Deciduous teeth have been known to have fickle root canal anatomy, one that nurtures the endodontic

microbiota in various fins and isthmi, leading to common occurrence of failure of endodontic procedures since a total disinfection poses a challenge to the dentist. Moreover, the traditional materials used for Pediatric Endodontics like Zinc oxide eugenol (ZOE) and Iodoform have some or the other disadvantages like slower or faster resorption rate, periapical irritation etc. The presence of erupting permanent in close vicinity further complicates this situation. All these factors have propelled the search for more efficacious and biologically sound material with better pharmacological qualities.<sup>1,2</sup>

In order to invent an ideal obturating material for a primary tooth, extensive and widespread research in field of Pediatric Endodontics has been undertaken but till date, no single chemical or compound has been found that does not result in an unwanted clinical outcome. Because of this inability of any one chemical to produce desired results in Pediatric Endodontics, a trend has taken foot where a natural product is clubbed with an established and traditional pediatric endodontic material. This resulted in introduction of Aloe vera and Propolis based pastes for use in the root canals of primary teeth. Natural extracts of Aloe, Triphala and neem, in combination with ZOE and Endoflas have led to promising clinical results that were corroborated by radiographic evidence as well.<sup>3-8</sup>

Recently multi-faceted usage of Curcumin has gained momentum in Pediatric Endodontics. Curcumin (diferuloylmethane) is an orange yellow coloured polyphenol compound. It is obtained from the rhizomes of *Curcuma longa* plant (family- Zingiberaceae) family which is found chiefly in tropical and subtropical regions of the world. Curcumin's use has been widely documented in Ayurvedic and Chinese preparations to

treat flatulence, menstrual difficulties, jaundice, hemorrhage, hematuria, and colic diseases. It has specific lipoxygenase and cyclooxygenase-2 inhibiting property which acts as a potent anti-inflammatory agent. Pharmacological research has revealed its wide spectrum of actions including antimicrobial, analgesic, antioxidant, chemo-sensitizing and immunomodulation<sup>8-10</sup>

Curcumin is now considered an antitumorigenic substance, meaning that because of its anti-apoptotic and antiproliferative efficacy, it has a unique ability to interfere with several tumour progression associated signalling pathways, and to modulate tumour-associated miRNA expression. Multiple studies have proven the efficacy of curcumin in treating oral precancerous conditions. Curcumin is used as an anti-inflammatory agent since it has an ability to interfere with signal transduction pathways, transcription factors, and cellular processes involved in course of inflammatory diseases.<sup>8,9</sup> Curcumin acts against microbes by inhibiting various bacteria, fungi and viruses. The inhibitory effects of curcumin on the cariogenic property of *Streptococcus mutans* are effective even at milder concentration of 0.5 to 4 mg/ml. It acts against *Enterococcus faecalis* (*E. faecalis*), commonly and repeatedly found in cases of failed obturation, and thus can be useful as a root canal medicament.<sup>11-14</sup>

Because of the virtue of Curcumin's antimicrobial, anti-inflammatory and anti-oxidant properties, it has a newfound role in dentistry including periodontal diseases, mouthwashes, plaque detection system, anticariogenic material, treatment of recurrent aphthous stomatitis, pulpotomy and pulpectomy.<sup>15-16</sup>

Despite the aforementioned wide array of usage, the literature available on curcumin is not sufficient.

Therefore, a literature search was carried out in order to find applications of Curcumin in various Pediatric Endodontic procedures.

### Methodology

A literature search is conducted using online databases such as 'Google Scholar', 'Pubmed' during the last 10 years and a narrative review is done using the keywords like 'Curcumin', 'pulpotomy', 'pulpectomy', 'obturator materials', 'primary teeth' etc.

Inclusion criteria were in-vitro studies, animal studies, clinical trials and case reports.

Exclusion criteria were abstracts, letter to editors and studies done on permanent teeth.

Chamele J et al (2014) did an in-vitro study to check the effectiveness of turmeric extract as an intracanal medicament in single-canal deciduous teeth against *Enterococcus faecalis*. The teeth were segmented and exposed to the bacteria in 3 groups. Group 1 was treated with a paste made from Turmeric extract. Group 2 to a paste comprising of calcium hydroxide & saline. Last group was not treated with any medicament. The study reached at a conclusion that Calcium hydroxide and Curcumin showed better antibacterial effect. Curcumin demonstrated a 50% reduction in colony count.<sup>17</sup>

Dhariwal NS et al (2016) used sodium hypochlorite, *Curcuma longa*, and *Camellia sinensis* as irrigants on isolated anaerobic bacteria from infected deciduous teeth to comparatively evaluate their efficacy. Preoperative radiographs were taken of 30 selected patients. Using sterile absorbent points, thirty samples were harvested from the root canals of infected primary teeth after working length measurements were made and transferred to tubes of thioglycolate transport medium. The bacteria were then subjected to antibiotic sensitivity testing using the three test irrigating solutions.

*Porphyromonas* sp., *Bacteroides fragilis*, *Peptostreptococcus*, and *Staphylococcus aureus* were most numbered. Sodium hypochlorite and *C. longa* (turmeric) showed good antibacterial effect while *C. sinensis* (green tea) was not much effective.<sup>18</sup>

Purohit RN et al (2017) used a preparation of turmeric powder, distilled water and radiopaque material in a group of 15 kids. These children, of age between 4 to 9 years had unilateral or bilateral carious molars and underwent pulpotomy with the aforementioned mix. The patients were followed up at intervals of 3 weeks, 2, 4 and 6 months. At the time of evaluation visit, clinical criteria were presence of pain, tenderness on percussion or mobility and radiographic criteria were periapical or furcation involvement. Only one patient complained of pain. None had any radiographic signs of failure. In 93.34% cases, the pain was reduced by a complete 100%.<sup>19</sup>

Hugar SM et al (2017) selected 90 primary molar teeth in 45 pediatric patients of age 4 to 9 years and were divided into experimental groups: Propolis extract was Group I, Turmeric gel was Group II, Calcium hydroxide was group III and Formocresol was fourth (control). After pulpotomy, the patients were followed up for 6 months for clinical signs (pain, soft tissue swelling or mobility) and radiographic signs (internal or external resorption, inter-radicular periapical bone loss, widening of PDL space). Follow up evaluation was done at 1, 3 and 6 months. At 6 months follow up, success rate in Gp I was 100% clinically and 93.3% radiographically as one tooth showed resorption but was clinically fine. In Gp II, 2 teeth showed signs of radiographic failure. Four teeth showed signs of radiographic failure in Calcium hydroxide group. In formocresol group, all teeth remained uneventful, hence a 100% success rate.<sup>20</sup>

Ambati et al (2017) determined the efficacy of Endoflas powder mixed with Curcumin gel as obturating material in a case series including 4 deciduous molars with irreversible pulpitis. The efficacy was evaluated both clinically and radiographically at 1 month and 3-month intervals. The Endoflas powder mixed with Curcumin gel, if extruded beyond apical foramen, was observed to resorb faster and within 1 week. It also demonstrated lesser inter-radicular radiolucency after 1 month and maintained so until a 3-month period.<sup>21</sup>

AR Prabhakar et al (2019) conducted an animal study on 12 Wistar-Albino rats to histologically compare curcumin and mineral trioxide aggregate (MTA) after pulpotomy in rat molars at the duration of 1 week, 2 weeks and a month under a light microscope. Both the materials showed a significant reduction in inflammatory response. The overall pulpal structure was maintained better in the curcumin group while dentinal bridge formation was found better in MTA group.<sup>22</sup>

Menni AC et al (2020), to overcome the limitations of eugenol in Endoflas, compared Curcumin gel mixed with Endoflas powder to Zinc oxide eugenol (ZOE) as obturating material in primary molars. 15 primary molars in 4-9-year-old children were obturated with Curcumin Gel mixed Endoflas powder (GP 1) and 15 with ZOE (Gp 2). At the end of the 6th month follow-up, there was 93.3% clinical success in Group 1 compared with 86.6% success in Group 2. Whereas, radiographically success reported was 100% with Group 1 and 93.3% with Group 2 which was statistically significant.<sup>23</sup>

Abd-Allah et al (2021) used 2% curcumin gel which was prepared with methylcellulose and turmeric powder as pulpotomy medicament. They selected 90 deciduous molars in 28 patients (4 to 7 years of age) for pulpotomy

and divided 3 ways according to the type of pulp dressing material, using Formocresol as control. The patients were followed up at periods of 1, 3 and 6 months. Radiographs were taken in last 2 visits. All cases in the three groups revealed clinical success at 1 month, 3 as well as 6 months follow up periods. Radiographic study displayed only statistically significant difference only after 6 months. Curcumin powder group revealed the highest prevalence of internal resorption followed by Curcumin gel. Formocresol group was least affected by internal resorption. The difference between survival of the three groups was not statistically significant though.<sup>24</sup>

Bommareddy CS et al (2022) chose 64 deciduous molars with irreversible pulpitis for single-sitting pulpectomy to evaluate the clinical and radiographic success rates of curcumin (Gp A), curcumin and calcium hydroxide in equal quantity (Gp B) and calcium hydroxide as an obturation material (Gp C) against iodoform and calcium hydroxide (Metapex). After 6 months, clinical and radiographic success rates of groups A, B, and C were at 81.3%, 61.5%, and 93.8%, respectively, while group D sat at a 100% success rate.<sup>25</sup>

Kumari N et al (2022) studied the efficacy of cryotherapy (using 2.5°C cold saline), curcumin, and normal saline as final irrigants in reducing post-endodontic pain in 120 primary teeth of kids of 4-7 age group. After chemo-mechanical preparation was done, final irrigation with 2.5°C cold saline, curcumin irrigant, and normal saline solution at room temperature was conducted. Visual Analog Scale was used in kids to assess the intensity of pain before, immediate postoperative after wearing off of local anesthetic effect, and 1 day after the procedure. The differences in

reduction of post-endodontic pain between the three irrigating regimens were statistically not significant.<sup>26</sup>

Aboubakr et al (2022) did an in-vitro study in primary anteriors to assess the antibacterial effect and smear layer removal ability of 12.5% turmeric extract solution in comparison to 2% chlorhexidine when used as root canal irrigants. 70 extracted primary anterior teeth were divided into 3 groups of 20 teeth each that were irrigated with 2% chlorhexidine solution (CHX), sterile saline and 12.5% turmeric solution respectively. Group (IV) was a positive control group of 5 teeth with only contamination (n=5 roots), Group (V) was a negative control group of 5 teeth with neither contamination nor irrigation. CHX group was shown to have a higher bacterial efficacy against *E. faecalis* than saline and turmeric irrigation solutions and had the least smear layer. The saline group had the maximum residual smear layer followed by the turmeric group.<sup>27</sup>

### Conclusion

In spite of various state-of-the-art technological advances, the present era shows a noticeable shift to phyto-therapeutics: a variety of alternative modalities to conventional and more acceptable endodontic treatments. Therefore, newer endodontic modalities have been developed based upon indigenous medicine and substances.

Although this review of literature supports and confirms the use of curcumin as an alternative agent in resolving several pulpal and periapical issues of primary teeth, intense research combined with a long-term follow up is required for its more successful application.

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