

Clinical and Radiographic Evaluation of 3Mix and Vitapex as Pulpectomy Medicament in Primary Molars: An *In Vivo* Study

Ramya Rai¹, Kukkalli K Shashibhushan², Prashant Babaji³, Pradeep M Chandrappa⁴, Vundela R Reddy⁵, Zeenath Ambareen⁶

ABSTRACT

Objective: To evaluate the clinical and radiographic success rates of 3Mix and Vitapex in the treatment of necrosed primary teeth.

Materials and methods: Seventy teeth of healthy children aged 4–9 years with necrotic primary molar (nonvital) were treated with 3Mix (lesion sterilization tissue repair therapy) and Vitapex before restoration with stainless steel crowns. The participants were followed up clinically and radiographically for 3 months and 6 months, respectively. The outcome was compared using Fisher exact test with a significance level of $p < 0.05$.

Results: Clinical success rate of 3Mix group at 3 months and 6 month follow-up was 100% and 97.14% and that of Vitapex group was 100% and 100%, respectively. The radiographic success rate of 3Mix group at 3 months and 6 months was 74.29% and 77.14% and of Vitapex group was 97.14% and 97.14%, respectively. Considering the clinical success, no statistical difference was found between the two groups at the end of 6 month ($p = 1.000$). But radiographically statistical significant difference was found between the two groups ($p = 0.028$).

Conclusion: Non-instrumentation endodontic treatment using 3Mix has shown a good clinical success of 97.14% but the radiographic success rate at 6 months was lower (77.14%). So it can be suggested that the use of 3Mix antibiotic treatment cannot replace conventional root canal treatment over the long term.

Keywords: 3Mix, Lesion sterilization and tissue repair care, Nonvital pulp treatment, Primary teeth, Vitapex.

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INTRODUCTION

In pediatric dentistry, root canal treatment in primary teeth is referred to as pulpectomy. Here, the term pulpectomy means removal of the caries and inflamed and necrotic pulp tissue, followed by cleaning and shaping of the canals, and finally obturating the tooth with a suitable resorbable material. The clinician who performs a pulpectomy procedure encounters difficulties because of the morphology of primary teeth coupled with physiologic resorption noted in primary teeth.¹ Much has been written regarding the possible damage to the developing permanent tooth bud from root canal obturating materials.

Vitapex consisting of calcium hydroxide iodoform in silicone oil as vehicle is considered as nearly ideal.² When the material is extruded into the periapical areas of the tooth being obturated, it is observed that the material is resorbed within weeks, thus considering it as an excellent resorbable material. However, studies have also shown that during the follow-up period, the tooth obturated with Vitapex showed faster resorption of the material than the physiologic resorption of the tooth which causes hollow area within the root canal space leading to probable chance of reinfection.^{3,4} Though the material is biocompatible, information on its antibacterial efficacy is not certain.⁵

Lesion sterilization and tissue repair care (LSTR) or non-instrumental endodontic treatment (NIET) is used as a new biologic approach in the treatment of necrosed primary tooth. In this technique, a mixture of 3 antibiotics: specifically, metronidazole, ciprofloxacin, and minocycline used to sterilize infected root dentine.⁶ LSTR has no mechanical instrumentation. This prevents enlargement of root canals and it conjointly reduces chair side time and needs only one treatment visit and causes less discomfort to the child⁵ and brings out the cooperative behavior. Ornidazole has been reported to own an extended length of action, with higher efficacy and slower metabolism compared with metronidazole.⁷

^{1-4,6}Department of Pedodontics and Preventive, Sharavathi Dental College and Hospital, Shivamogga, Karnataka, India

⁵Department of Pedodontics and Preventive Dentistry, Sri Siddhartha Dental College and Hospital, Tumakuru, Karnataka, India

Corresponding Author: Ramya Rai, Department of Pedodontics and Preventive Dentistry, Sharavathi Dental College and Hospital, Shivamogga, Karnataka, India, Phone: +91 8762627445, e-mail: rrai8@gmail.com

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Hence, in the present study, metronidazole was replaced by ornidazole. Hence, this study was conducted to evaluate the success of 3Mix and Vitapex each clinically and radiographically for pulp therapy of primary teeth.

MATERIALS AND METHODS

Seventy infected primary molars (non-vital) from 56 healthy children aged 4–9 years were selected from OPD of Pedodontics and Preventive Dentistry, Sharavathi Dental College and Hospital Shivamogga. Participation in the study was voluntary and a written informed consent was obtained from the parents and guardians of the patients before starting the treatment. Ethical clearance was obtained from the Institutional Ethical Committee. Criteria for tooth selection: Primary molars selected in this study were based on clinical and radiographic screening.⁷ (a) Pulpally involved primary teeth (nonvital), (b) gingival abscess, presence of fistula, (c) failed pulpotomy, (d) teeth with radiographic evidence of internal or



Fig. 1: Placement of triple antibiotic paste



Fig. 2: Obturation done using Vitapex

external root resorption, and (e) furcation or periapical radiolucency were included in the study.

(a) Nonrestorable tooth, (b) excessive root resorption involving more than half of the root, (c) teeth with pulpal floor perforation, and (d) systemically compromised and patients with history of drug allergy were excluded from the study.

Preparation of 3Mix Antibiotic Paste

Commercially available chemotherapeutic agent such as Ciprofloxacin tablets 500 mg (Ciplox, Cipla Ltd., India), Ornidazole tablets 500 mg (Ornida, Aristo pharmaceuticals, India), and minocycline tablets 100 mg (Minoz OD, Ranbaxy Laboratories Ltd., India) was used in the study. Enteric coating of these antibiotics was removed and it was pulverized using porcelain mortar and pestle. The powdered antibiotics were stored in airtight containers.

The amount of each drug (1:3:3) (one part of ciprofloxacin, three part of ornidazole, and three part of minocycline) was mixed together. After that, the mixed drugs were combined with propylene glycol.

The selected 70 teeth were randomly divided into group I and group II with 35 teeth each.

Group I (3Mix)

Adequate local anesthesia was administered using lignocaine 2% with adrenaline. Tooth was isolated with rubber dam. Access cavity was prepared using a round bur making sure that all the overhanging edges are eliminated. Both coronal and accessible radicular necrotic pulp tissue was removed using a sterile sharp spoon excavator and barbed broaches. Canals were irrigated with normal saline. A mixture of 3Mix (ciprofloxacin, ornidazole, and minocycline) was placed on the floor of the pulp chamber covering the root canal orifice (Fig. 1) and then the teeth were restored with glass ionomer cement, followed by stainless steel crown.

Group II (Vitapex)

Adequate local anesthesia was administered using lignocaine 2% with adrenaline. The tooth was isolated with rubber dam and access cavity was prepared with round bur in high-speed handpiece, and necrotic pulp tissue was removed using a sterile sharp spoon excavator and barbed broaches. The root length was determined using diagnostic radiograph. Rubber stopper was placed appropriately on the number 15 K-file. On the subsequent appointment filling was carried out approximately 2–3 mm short



Fig. 3: Stainless steel crown adaptation done

of radiographic apex. Each canal was enlarged 2–3 instrument sizes larger than the first file. Copious irrigation was done with saline and the canals were dried with paper points and Vitapex (Neo dental co., Tokyo, Japan) was filled in directly by a prepacked syringe (Fig. 2). Glass ionomer cement was used to fill the pulp chamber and the teeth were restored with stainless steel crown (Fig. 3).

Postoperative evaluation was performed at 3 months and 6-month interval. Clinically, the criteria for success were those patients who had initial pain, abscess, fistula openings, or abnormal mobility where completely free of clinical signs and symptoms. The criteria for radiographic success were reduced or absence of furcation radiolucency/periapical radiolucency, no progression of external resorption, and no newly formed radiographic lesions (Figs 4 and 5).

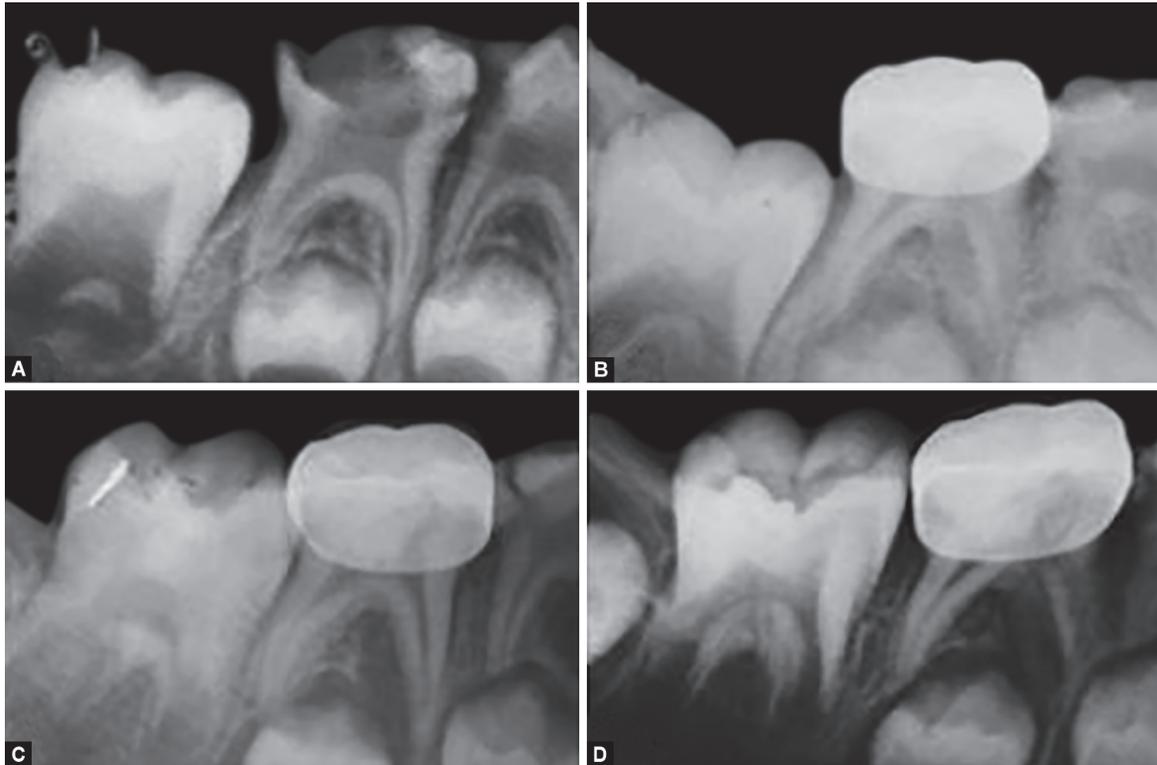
RESULTS

Each group comprised of 35 non-vital primary molars with poor prognosis. Before treatment, majority of the teeth in two groups presented with pain, percussion sensitivity, gingival swelling, and pathological tooth mobility. Pre- and postoperative clinical examinations at 3 months and 6 months are shown in Table 1. Pre- and post-operative radiological examinations at 3 months and 6 months are shown in Table 2. Clinical and radiographic success rates of 3Mix and Vitapex at 3 months and 6 months are shown in Table 3.

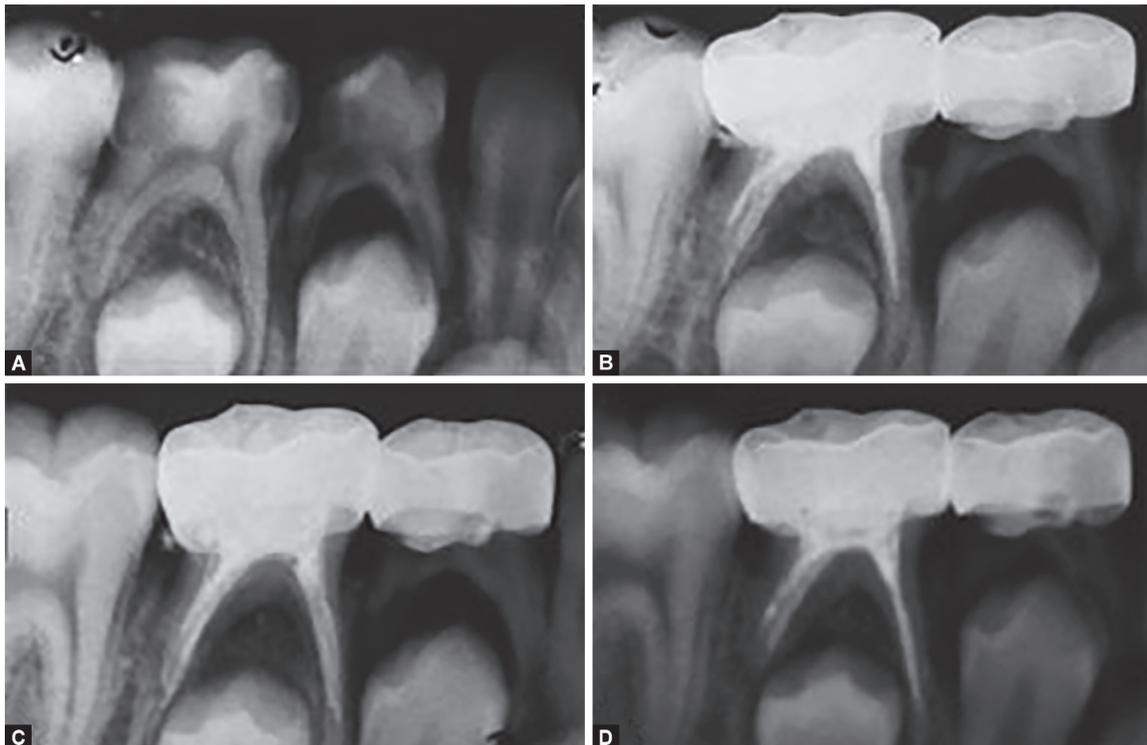
Postoperative Clinical Findings

At 3 months, both the groups showed 100% clinical success and at 6-month follow-up in 3Mix group showed 97.14% clinical success,

and in Vitapex group 100% clinical success was noted. Regarding clinical success, no significant difference was found between the two groups (Figs 6 and 7).



Figs 4A to D: 3Mix: (A) Preoperative radiograph; (B) Postoperative radiograph; (C) 3rd month; (D) 6th month



Figs 5A to D: Vitapex: (A) Preoperative radiograph; (B) Postoperative radiograph; (C) 3rd month; (D) 6th month

Table 1: Comparison of clinical parameters among two groups during follow-up

Clinical		3Mix	Vitapex	Fisher exact test
Pain	Preoperatively	35 (100)	35 (100)	NA
	3 months	0 (0)	0 (0)	NA
	6 months	2 (5.71)	0 (0)	0.493
Percussion sensitivity	Preoperatively	28 (80)	24 (68.57)	0.413
	3 months	0 (0)	0 (0)	NA
	6 months	1 (2.86)	0 (0)	0.999
Gingival swelling	Preoperatively	30 (85.71)	24 (68.57)	0.153
	3 months	0 (0)	0 (0)	NA
	6 months	0 (0)	0 (0)	NA
Sinus/fistula	Preoperatively	6 (17.14)	4(11.43)	0.734
	3 months	0 (0)	0 (0)	NA
	6 months	0 (0)	0 (0)	NA
Pathological tooth mobility	Preoperatively	12 (34.29)	5 (14.29)	0.093
	3 months	0 (0)	0 (0)	NA
	6 months	0 (0)	0 (0)	NA

Table 2: Comparison of radiological parameters among two groups during follow-up

Radiological		3Mix	Vitapex	Fisher exact test
Furcal radiolucency	Preoperatively	35 (100)	34 (97.14)	0.999
	3 months	9 (25.71)	1 (2.86)	0.013
	6 months	8 (22.86)	1 (2.86)	0.028
Periapical radiolucency	Preoperatively	10 (28.57)	4(11.43)	0.133
	3 months	3 (8.57)	1 (2.86)	0.614
	6 months	2 (5.71)	1 (2.86)	0.999
External resorption	Preoperatively	6 (17.14)	2 (5.71)	0.259
	3 months	12 (34.29)	2 (5.71)	0.006
	6 months	17 (48.57)	5 (14.29)	0.004

Table 3: Clinical and radiographic outcome of 3Mix and Vitapex

Results	Follow-up period	3Mix	Vitapex	p value
Clinical success	3	35/35 (100)	35/35 (100)	NA
	6	34/35 (97.14)	35/35 (100)	1.000
Radiographic success	3	26/35 (74.29)	34/35 (97.14)	0.013
	6	27/35 (77.14)	34/35 (97.14)	0.028

Postoperative Radiological Findings

Radiographic assessment of 3Mix and Vitapex groups at 3 months revealed 74.29% and 97.14%, respectively ($p = 0.013$), and at 6 months, 77.14% success was observed in 3Mix and in Vitapex 97.14% success was seen ($p = 0.028$). Considering the radiographic findings at the end of 3-months and 6-month follow-up, statistical significant difference was found between the groups ($p < 0.05$) (Figs 6 and 7).

DISCUSSION

In the present study, clinical and radiographic success of 3Mix and Vitapex group was compared. The criterion for tooth selection for the present study was based on the studies by Nakornchai et al.,⁵ Prabhakar et al.,⁸ and Pinky et al.⁷ As this was a 6 month follow-up study, the selection criteria were meticulously followed in order to avoid complications during the study period. Likewise, children selected were in the age group of 4–9 years. Isolation was rigidly followed by using

rubber dam. This was done to prevent contamination of the working area thereby affecting success of treatment.

Traditional or conventional Hoshino's paste consisted of ciprofloxacin, metronidazole, and minocycline. One of the earliest *in vitro* studies conducted by Sato et al.⁶ proved that this drug combination effectively sterilized the necrosed root canals of primary teeth. Further, this combination has shown promising results in several *in vivo* studies conducted by Takushige et al.⁹ and Prabhakar et al.⁸ In the present study in 3Mix group, mixture of three antibacterial drugs namely ciprofloxacin, ornidazole, and minocycline in a ratio of 1:3:3 was used which is in accordance to the study conducted by Takushige et al.,⁹ Prabhakar et al.,⁸ and Pinky et al.⁷ Other researchers like Nakornchai et al.⁵ used 1:1:1 ratio of antibacterial drug in their study. Kargül et al. observed that the antibacterial activity of ornidazole caused significant changes in rates of microorganisms (94.53% reduction).¹⁰ Hundred percent clinical success rate was observed in study conducted by Pinky et al. at the end of 12 months, which may be attributed to use of

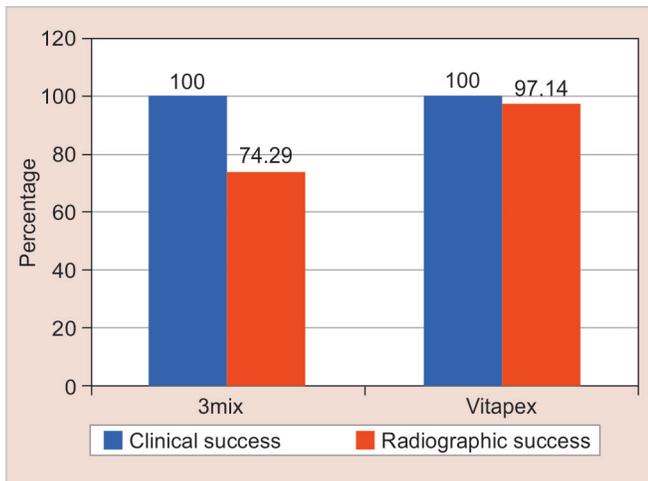


Fig. 6: Clinical and radiographic success of 3Mix and Vitapex at 3rd month

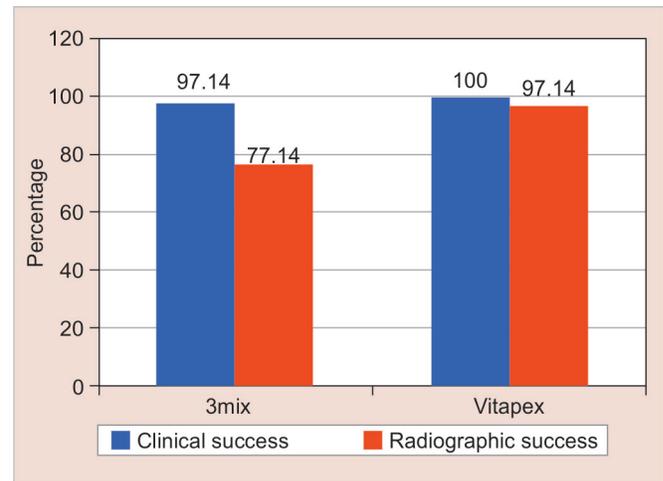


Fig. 7: Clinical and radiographic success of 3Mix and Vitapex at 6th month

ornidazole instead of metronidazole. Ornidazole has been reported to have a longer duration of action, with better efficacy and slower metabolism compared with metronidazole.⁷ In the present study, propylene glycol was added to this mixture as a vehicle. Cruz et al. found that propylene glycol delivered dye through the root canal system rapidly and more effectively indicating its potential use in delivering intracanal medicament.¹¹

In the study conducted by Takushige et al.,⁹ Prabhakar et al.,⁸ Nanda et al.,¹² and Pinky et al.,⁷ medication cavity was prepared prior to the placement of 3Mix in which the orifice were enlarged with straight bur to receive the medicament. However, medication cavity was not prepared in the present study. Following access cavity preparation, all the necrotic coronal pulp tissue as well as accessible radicular pulp tissue was removed as extirpation of radicular pulp along with coronal necrotic pulp has shown better results.⁸ In the Vitapex group, multiple visit procedure was followed following preparation of the root canal obturation was done using the prepacked syringe, when the patient was free of all clinical signs and symptoms. Zinc oxide eugenol was used to fill the pulp chamber and the teeth were restored with stainless steel crown on subsequent visit. The procedure followed in the present study in both the groups is similar to study conducted by Nakornchai et al.⁵

The samples in both groups were evaluated clinically and radiographically at 3 months and 6 months. At 3-months follow-up both 3Mix and Vitapex groups revealed excellent clinical signs of success with no signs of pain, percussion sensitivity, gingival swelling, sinus/fistula, and pathological tooth mobility.

Clinical evaluation at 6-month follow-up revealed presence of pain in two teeth (5.71%), percussion sensitivity in one tooth (2.86%), in 3Mix group. Complete absence of clinical signs was seen in Vitapex group at 6-month follow-up. In a study conducted by Trairatvorakul et al.¹³ at 6-month follow-up in 3Mix group observed 4 cases (5.1%) with pathological tooth mobility; however, in the present study, no patients presented with pathological tooth mobility, and dissimilar results were observed in study by Duandaun¹⁴ where pain and sinus tract was observed in one case in Vitapex group and only one case in 3Mix group reported with pain in 6–12-months follow-up period.

On comparison of clinical success rate at 3-months follow-up between 3Mix and Vitapex showed 100% clinical success rate, and

at 6 months, clinical success rate in 3Mix was 97.14% and 100%, respectively. The results were not statistically significant. Almost comparable results were observed in study by Nakornchai et al.⁵ where they observed 100% clinical success at 6-month follow-up in both 3Mix and Vitapex groups. Study by Pinky et al.⁷ showed 100% clinical success at 6 months in 3Mix group where the result is attributed to the presence of Ornidazole, which is similar to the present study. Almost consistent results were observed in study by Takushige et al.⁹ and Prabhakar et al.,⁸ where 100% clinical success was found with 3Mix group. Clinical success in both the groups in the present study proved to be equally good with clinical advantage of 3Mix being simple technique and no instrumentation thereby reducing chair side time and only one visit was required.¹⁵

On comparing the radiographic evaluation between 3Mix and Vitapex groups, in the present study radiographic evaluation in the 3-month follow-up revealed 9 teeth (25.71%) in 3Mix group and 1 tooth (2.86%) in Vitapex group continued to have furcal radiolucency and the results were statistically significant ($p < 0.05$). At 6-month follow-up in 3Mix group furcal radiolucency was decreased in 1 tooth thereby only 8 teeth (22.86%) revealed furcal radiolucency. In Vitapex group, furcal radiolucency was present in one tooth (2.86%), and the results were statistically significant ($p < 0.05$).

Similar results were observed by Trairatvorakul et al.,¹³ and five cases (11.9%) were reported with furcal radiolucency involving more than half the length of the shortest root in vertical measurement in 3Mix group at 6-month follow-up. Nakornchai et al.⁵ observed the presence of furcal radiolucency in 2 cases (8%) in 3Mix group and 3 cases (12%) in Vitapex group at 6-month follow-up. Duandaun¹⁴ observed 1 case in 3Mix group and 7 cases in Vitapex group with furcal radiolucency which is in contrary to the present study where only 1 tooth (2.86%) in Vitapex presented with furcal radiolucency at the end of 6-month follow-up.

In the present study, periapical radiolucency was observed in 3 teeth (8.57%) at 3-months follow-up in 3Mix group and 1 tooth (2.86%) in Vitapex group.

In 6-month follow-up, 2 teeth (5.71%) in 3Mix group and 1 tooth (2.86%) in Vitapex showed the presence of periapical radiolucency. Results were however not statistically significant. Contrary to this, Nakornchai et al.⁵ observed 2 cases (8%) in 3Mix and 5 cases (20%) with periapical radiolucency at 6-month follow-up.

External resorption in the present study was found in 12 teeth (34.29%) in 3Mix at 3 months and 2 teeth (5.71%) in Vitapex group. Results were statistically significant, and at 6-month follow-up 17 teeth (48.57%) in 3Mix group and 5 teeth (14.29%) in Vitapex showed external resorption. Teeth belonging to 3Mix group showed increased percentage of external resorption at 6 months when compared to Vitapex group and the results were statistically significant ($p < 0.05$). Contrary to this, external resorption was found to be less in 3Mix group compared to Vitapex group in study conducted by Nakornchai et al.⁵

On comparing the radiological success at 3 months between 3Mix and Vitapex showed 74.29% and 97.14%, respectively, and the results were statistically significant ($p < 0.05$). Study conducted by Mortazavi et al.¹⁶ has reported a success rate of 100% with Vitapex and Garcia-Godoy² has reported a success rate of 96% with Vitapex which is similar to the present study where Vitapex showed good clinical and radiographic success with statistically significant results. Nakornchai et al.⁵ reported a radiographic success in 3Mix and Vitapex of 84% and 80%, respectively, at 6-month follow-up and the results were not statistically significant.

Study conducted by Sadaf et al.¹⁷ showed dissimilar results compared to the present study, wherein the overall radiographic success between 3Mix and Vitapex was 90% and 70%, respectively, after 6 months. The results of the present study was much encouraging than the study conducted by Duandaun¹⁴ where radiographic success of Vitapex was 64.6% and 3Mix group was 65.2%, respectively, and was not statistically significant, but in the present study, there was statistically significant difference observed ($p < 0.05$) between the two groups.

Important observation in the current work is that both 3Mix and Vitapex showed good clinical success rate at the end of 6 months with statistically nonsignificant result which may be because of high antibacterial effectiveness of 3Mix which suggests that non-instrumentation technique might be more suitable in cases of poor prognosis. Other clinical advantage of 3Mix technique is less chair time and only one visit was required for treatment, therefore might be an optimal treatment for an uncooperative child.

In the present study, Vitapex showed statistically significant radiographic success ($p < 0.05$) at the end of 6-month follow-up compared to 3Mix and this may be related to the inclusion criteria, technique, and pre- and postoperative radiographic evaluations.

CONCLUSION

Within the limits of the present study, we conclude that NIET using 3Mix is a promising medicament in the treatment of teeth with poor prognosis. However, further clinical and radiological trials are needed with supporting histological evidence with longer follow-up period till exfoliation of the treated primary teeth. This will help in better understanding of effectiveness of this treatment approach.

CLINICAL SIGNIFICANCE

The simple and short procedures of 3Mix may be superior to other materials used for root canal treatments in poor prognosis teeth.

NIET using 3Mix is a good treatment option in young uncooperative patient and specially abled children.

Vitapex proves to be nearly ideal obturating material in poor prognosis teeth.

REFERENCES

1. Waterhouse PJ, Whitworth JM, Camp JH, et al. Pediatric endodontics: Endodontics treatment for the primary and young permanent dentition. In Hargreaves KM, Cohen S, ed. *Cohen's Pathways of the Pulp*, 10th ed. Elsevier Publishers; 2011. pp. 808–857.
2. Nurko C, Garcia-Godoy F. Evaluation of a calcium hydroxide/iodoform paste (Vitapex) in root canal therapy for primary teeth. *J Clin Pediatr Dent* 1999;23(4):289–294.
3. Ozalp N, Saroglu I, Sonmez H. Evaluation of various root canal filling materials in primary molar pulpectomies: an *in vivo* study. *Am J Dent* 2005;18(6):347–350.
4. Nurko C, Ranly DM, Garcia-Godoy F. Resorption of a calcium hydroxide/iodoform paste (Vitapex) in root canal therapy for primary teeth: a case report. *Pediatr Dent* 2000;22(6):517–520.
5. Nakornchai S, Banditsing P, Visetratana N. Clinical evaluation of 3 Mix and vitapex as treatment options for pulpally/involved primary molars. *Int J Paediatr Dent* 2010;20(3):214–221. DOI: 10.1111/j.1365-263X.2010.01044.x.
6. Sato I, Kurihara NA, Kota K, et al. Sterilization of infected root-canal dentine by topical application of a mixture of ciprofloxacin, metronidazole and minocycline *in situ*. *Int Endod J* 1996;29(2):118–124. DOI: 10.1111/j.1365-2591.1996.tb01172.x.
7. Pinky C, Shashibhushan KK, Subbareddy VV. Endodontic treatment of necrosed primary teeth using two different combinations of antibacterial drugs: an *in vivo* study. *J Indian Soc Pedod Prev Dent* 2011;29(2):121–127. DOI: 10.4103/0970-4388.84684.
8. Prabhakar AR, Sridevi E, Raju OS, et al. Endodontic treatment of primary teeth using combination of antibacterial drugs: an *in vivo* study. *J Indian Soc Pedod Prev Dent* 2008;26(1):5–10. DOI: 10.4103/0970-4388.40313.
9. Takushige T, Cruz EV, Moral AA, et al. Endodontic treatment of primary teeth using a combination of antibacterial drugs. *Int Endod J* 2004;37(2):132–138. DOI: 10.1111/j.0143-2885.2004.00771.x.
10. Kargül B, Kadir T. The antibacterial effects of ornidazole on primary molars with infected pulps. *Chemotherapy* 2001;47(3):203–207. DOI: 10.1159/000063222.
11. Cruz EV, Kota K, Huque J, et al. Penetration of propylene glycol into dentine. *Int Endod J* 2002;35(4):330–336. DOI: 10.1046/j.1365-2591.2002.00482.x.
12. Nanda R, Koul M, Srivastava S, et al. Clinical evaluation of 3 Mix and Other Mix in non-instrumental endodontic treatment of necrosed primary teeth. *J Oral Biol Craniofac Res* 2014;4(2):114–119. DOI: 10.1016/j.jobcr.2014.08.003.
13. Trairatvorakul C, Detsomboonrat P. Success rates of a mixture of ciprofloxacin, metronidazole, and minocycline antibiotics used in the non-instrumentation endodontic treatment of mandibular primary molars with carious pulpal involvement. *Int J Paediatr Dent* 2012;22(3):217–227. DOI: 10.1111/j.1365-263X.2011.01181.x.
14. Duanduan A. Retrospective study of pulpectomy with Vitapex and LSTR with three antibiotics combination (3mix) for non vital pulp treatment in primary teeth. *CMU J Nat Sci* 2013;12(2):131–139. DOI: 10.12982/CMUJNS.2013.0012.
15. Theerapiboon U. Pulp Therapy in Primary Teeth with Three Mix Antibiotics. *Chiang Mai Dent J* 2012;33(1):15–27.
16. Mortazavi M, Mesbahi M. Comparison of zinc oxide and eugenol, and Vitapex for root canal treatment of necrotic primary teeth. *Int J Paediatr Dent* 2004;14:417–424. DOI: 10.1111/j.1365-263X.2004.00544.x.
17. Qadeer S, Munir B, Dar SY. Comparison Of Effectiveness Of Triple Antibiotic Paste (3mix) And Vitapex For Root Canal Treatment Of Pulpally Involved Primary Molars. *Pak Oral Dent J* 2016;36(4):654–657.