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Comparative Clinical And Radiographic Evaluation Of Dycal And Prevest Cal Lc As Indirect Pulp Capping Material In Primary Molars: 12 Months Clinical Study.

Author

Abstract
Background: *Minimally invasive techniques should be employed to maintain pulp vitality without affecting physiological tooth resorption for paediatric patients. Indirect pulp capping (IPC) is a treatment in which biocompatible material such as Calcium hydroxide has traditionally been used as the pulp capping material that preserves pulp vitality. The tunnel defects in the barrier and the tendency for dissolution, however, fails to provide permanent protection to the pulp. Light curable resin based cements have been introduced to enable a better marginal seal and lesser dissolution.*
Aim: *The purpose of the study was to compare and evaluate the clinical efficiency of light-cured calcium hydroxide (Prevest Cal LC) and Self-cure calcium hydroxide(Dycal) as indirect pulp capping material in primary molars.*
Methodology: *The study design was randomized control trial in which total of 78 patients age between 4-8 years were randomly divided into two groups (n=39). Group A was treated with Self-cure calcium hydroxide (Dycal), while group B was treated with (light-cured calcium hydroxide) Prevest cal LC. Postoperative clinical examination was conducted to check for postoperative pain, tenderness, and neural sensibility, and radiographical examination was conducted to check for periodontal ligament space widening, presence of calcific barrier, and periapical radiolucency at patient recall of 4,8 and 12 months interval.*
Results*: Clinical Success rate for Self-cured calcium hydroxide (group 1) at follow-up came out to be 100% at 4 months,82.1% at 8 months, and 85.71% at 12 months. The success rate for Prevest Cal LC group came out to be100% at 4 months,94.73% at 8 months, and 97.29% at 12 months. The overall Radiographical success rate for IPC procedure was 88.57% and 97.29% at 12 months follow-up for group 1 and group 2 respectively. There were statistically significant differences between the materials ($p<0.05$).*
Conclusion: *Based on the findings of the present study and considering the limitations of conventional pulp capping materials, it can be concluded that light-cure calcium hydroxide cements offer a reliable alternative to conventional self-cured cements for indirect pulp capping in deep carious lesions.*
Key words *– Deciduous teeth, indirect pulp treatment, Calcium hydroxide, light cure)*

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I. Introduction

Dental caries is a prevalent oral health issue among children and is recognized as one of the most common chronic conditions affecting them. Early detection and careful management of carious lesions are important steps in eliminating any stimuli that could affect the viability of dentin pulp complex. Managing deep carious lesions in primary teeth presents a significant challenge.[1] Indirect pulp capping (IDPC) is recommended for teeth with deep cavities near the pulp that do not exhibit any indications or symptoms of pulp injury. This procedure involves covering the deepest layer of dentin using biocompatible materials.[2] For indirect pulp capping, several materials have been introduced, including calcium hydroxide (CH), resin-modified glass ionomer (RMGI), and dentin bonding agents. for use as pulp capping agents in the management of vital teeth with deep cavities. [3,4]

Calcium hydroxide (CH) is considered as the gold standard among all pulp capping agents utilised. Its use was first suggested by Zander.[5] However, there are certain drawbacks associated with self-cured CH. One such drawback is the development of tunnel defects due to the gradual breakdown of the newly generated dentin. This paved way for other IPC materials to improve the properties of conventional calcium hydroxide cements such as resin-based cements. these materials are light-cured, highly resistant to etchants, present superior physical properties, and handling characteristics.[6]

Only a few clinical trials have been conducted so far, determining the clinical efficacy and successful outcome of resin based light-cured IPC agents in primary teeth with deep caries. Hence, there is a requirement for more studies on these two materials. The objective of our study was to evaluate Efficiency of Self cured

calcium hydroxide And light cute calcium hydroxide as pulp capping agents (Figure 1.(a) and (b)) in primary molars.

II. Materials And Method

A randomized control trial was conducted in the Department of Pedodontics and Preventive Dentistry of Government Dental College and Hospital, Ahmedabad. Informed consent was obtained from parents/guardians of all children included in this study before the procedure.

The sample comprised 78 deciduous teeth with occlusal caries in maxillary and mandibular primary molars in 62 healthy children aged between 4-8 years and children with occlusal caries in maxillary and mandibular primary molars were selected and were randomly divided into 2 groups.

Group I: Self-cure calcium hydroxide (Dycal) (n=39)

Group II: Light cure calcium hydroxide (Prevest Cal LC) (n=39)

Figure 1: Materials used in the study (a)Prevest Cal LC; (b)Dycal;

Selection criteria

Inclusion criteria

- Healthy cooperative (Frankle's rating scale 3&4) Children between 5 and 8 years with deep occlusal caries in primary molars
- No history of spontaneous pain and tenderness to palpation or percussion
- Absence of pathological mobility
- Radiographic evidence of intact lamina dura and dental caries close to pulp
- Physiological root resorption not more than apical one-third of root surface of the tooth to be treated.

Exclusion criteria

- Patients with history of Sharp continuous pain
- Fistula, abscess and swelling of soft and periodontal tissues
- Pathological mobility
- Radiographic sign of pulp involvement, interradicular or periapical radiolucency or internal/external root resorption.

Procedure

After administration of Local Anasthesia (2% lignocaine with epinephrine) The tooth was isolated with a rubber dam. After that Using a slow speed round bur, the superficial caries layer was removed. The rest of the soft caries present in the deep layers was removed carefully with a small and medium size spoon excavator (EXC19H, GDC fine crafted Dental pvt. Ltd) until firm dentine was confirmed by tactile method. Disinfection of cavity was done with 2% chlorhexidine gluconate followed by irrigation with saline. The cavity was dried using cotton pellets. In Group 1 Self cured calcium hydroxide (Dycal, Dentsply Caulk, Milford, DE, USA) was placed. (Figure 2) In group 2 Light cure calcium Hydroxide (Cal LC- Prevest DenPro, Jammu, India) was placed and light cure as per manufacturer's instructions. (Figure 3) the cavity was restored with glass ionomer cement (GC Gold Label 9, GC Corporation, Tokyo, Japan cement). Then the restoration was coated with a layer of petroleum jelly. After finishing the procedure, an IOPA of the tooth was recorded.

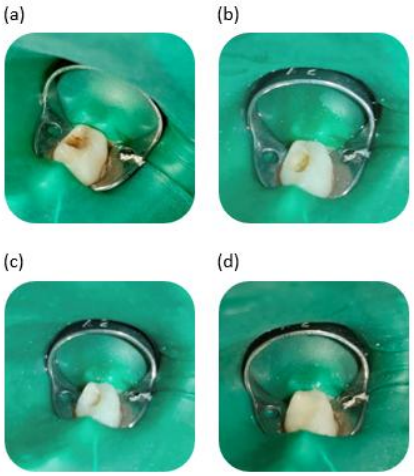


Figure 2. Clinical procedure of group 1;(a)rubber dam applied;(b)caries excavation done;(d)dycal applied; (e)restoration done

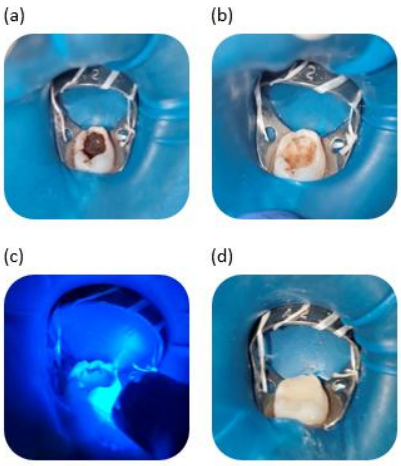


Figure 3. Clinical procedure of group 2;(a)rubber dam applied;(b)caries excavation done;(d)Cal lc applied and light cured; (e)restoration done

Evaluation criteria

Clinical and Radiograph performance were evaluated at 4, 8 and 12 months follow-up period.

Clinical evaluation criteria

- Absence of spontaneous pain
- Absence of sensitivity to percussion and palpation
- Absence of abnormal tooth mobility
- No abscess or sinus formation.

Radiograph evaluation criteria

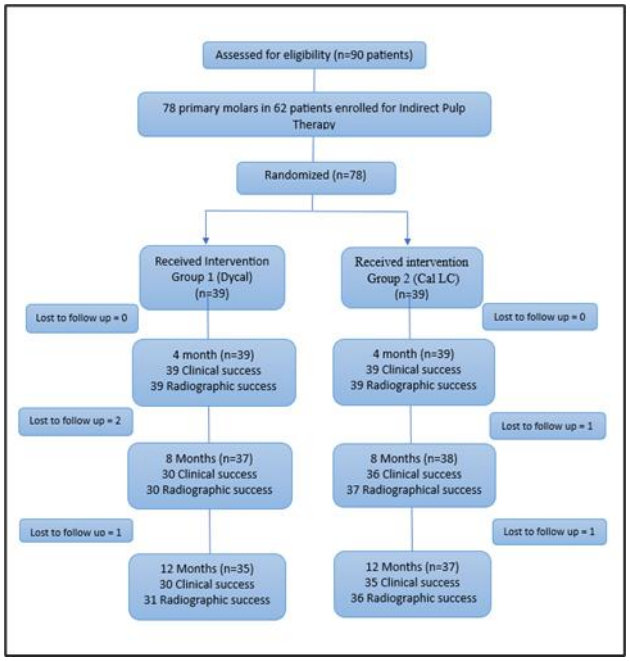
- Intact lamina dura
- Presence of normal development of permanent successor
- Normal physiological root resorption
- Lack of periapical/interradicular pathology and pathological internal and external tooth resorption.

III. Results

Statistical analysis

After collection of data, the data were coded and entered in Microsoft Excel 2019. The descriptive statistics were presented as proportions. Proportions were compared using Chi square test. Statistical Package for Social Science (SPSS version 23, IBM). Level of significance was set at $P<0.05$.

The data pertaining to eligibility, intervention and number of participants accessed at different time intervals is presented in Flow chart -1 where 90 patients with reversible pulpitis were screened. Out of that, 78 patients were randomly allocated to test groups: Dycal and Prevest Cal LC, who were followed up for 4, 8, 12 months.



Flow chart 1: Flow chart of the study subjects from baseline to 12 months follow up

Table 1: Mean age and gender distribution of the study subjects

Gender	N	Mean(year)	Std. deviation
Male	40	5.35±1.28	1.28
Female	38	5.35±1.26	1.26

Table 1 shows the mean age and gender distribution of participants.

Table 2 compares clinical failure parameters between Dycal and Cal Lc at 4, 8, and 12 months interval. At 4 months, both groups showed no signs of failure. By 8 months, the Dycal group showed higher incidence of 7 clinical failures compared to Cal Lc, which had only 2 clinical failures for both pain and abscess formation. At 12 months, Dycal continued to show higher failure rates with 5 clinical failures, while Cal Lc showed only 1 failure and no other failures. Overall, Cal Lc demonstrated better clinical outcomes with fewer complications over time.

Table 2: intergroup comparision of clinical parameters of failure at 2 months, 4 months and 6 months

		Spontaneous Pain F (%)	Sensitivity to Percussion F (%)	Mobility F (%)	Abscess/ sinus formation F (%)
4 Month	Dycal (n=39)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Cal Lc(n=39)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
8 Month	Dycal (n=37)	3 (8.1%)	2(5.4%)	1(2.7%)	1(2.7%)
	Cal Lc(n=38)	1 (2.6%)	0(0%)	0(0%)	1(2.6%)
12 Month	Dycal(n=35)	2(5.7%)	1(2.8%)	0(0%)	2(5.7%)
	Cal Lc(n=37)	1(2.7%)	0(0%)	0(0%)	0(0%)

Table 3 compares the radiographic failure outcomes between the two groups. At 4 months, neither group showed any signs of radiographic failure. By the 8-month mark, the Dycal group exhibited 7 radiographic failures, while the Cal LC group remained free of any failures. At 12 months, Dycal continued to show a higher rate of failure with 4 additional cases, whereas Cal LC reported only a single failure. These findings indicate that Cal LC had more favorable radiographic outcomes over time compared to Dycal.

Table 3 : Intergroup comparision of Radiographic parameters of failure at 2,4 and 6 months

		Lamina dura F (%)	Development of successor F (%)	Mobility F (%)	Abscess/ sinus formation F (%)
4 Month	Dycal (n=39)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Cal Lc(n=39)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
8 Month	Dycal (n=37)	3(8.1%)	2(5.4%)	1(2.7%)	1(2.7%)
	Cal Lc(n=38)	0(0%)	0(0%)	0(0%)	1(2.6%)
12 Month	Dycal(n=35)	2(5.7%)	0(0%)	0(0%)	2(5.7%)

	Cal Lc(n=37)	1(2.7%)	0(0%)	0(0%)	0(0%)

Table 4 presents the comparative overall success rates of Dycal and CAL LC in terms of radiographic and clinical success at 4, 8, and 12 months post-treatment in primary teeth. At 4 months, both Dycal and CAL LC showed 100% radiographic and clinical success, with no statistically significant difference (p = 1.000). At 8 months, radiographic success rates decreased slightly to 83.78% for Dycal and 97.36% for CAL LC, with a non-significant chi-square value (p = 0.083). However, clinical success showed a statistically significant difference between the groups (Dycal: 83.78%, CAL LC: 97.29%, p = 0.045). By 12 months, clinical success remained higher for CAL LC (97.29%) compared to Dycal (82.86%), and this difference was statistically significant (p = 0.042). Overall, while both materials showed high initial success, CAL LC demonstrated significantly better clinical outcomes at later follow-ups.

Table 4- Comparative overall success rate of Dycal and CAL LC at 2 months, 4 months and 6 months

		Radiographical success	Clinical success
4 Month	Dycal (n=39)	100%- Success (39)	100%- Success (39)
	Cal Lc(n=39)	100%- Success (39)	100%- Success (39)
	Chi square	0.000	0.000
	P value	1.000 (NS)	1.000 (NS)
8 Month	Dycal (n=37)	83.78%success	81.1% success
	Cal Lc(n=38)	97.36%success	94.73%success
	Chi square	5.09	4.08
	P value	0.024(S)	0.0434(S)
12 Month	Dycal(n=35)	88.57%success	85.71%success
	Cal Lc(n=37)	97.29%success	97.29 %success
	Chi square	4.24	4.13
	P value	0.0397(S)	0.042(S)

IV. Discussion

An Indirect pulp treatment procedure not only maintains the vitality of carious tooth, but also lowers the micro-organisms near the pulp and halts the progression of caries. The success of IPC is depends on several factors, including the nature of the biomaterial used most notably its biocompatibility and bioactivity, level of bacterial contamination, remaining dentine thickness, the capacity to achieve effective isolation, the quality of coronal seal to avoid microleakage, and judicious case selection based on clinical and radiographic criteria.[7]

Clinical studies have effectively proved the success of calcium hydroxide compounds as IPC agents. Marchi et al. (2006) [8] conducted a 4- year follow-up study and reported 88% success rate for calcium hydroxide after indirect pulp capping in primary teeth. However, in long-term clinical studies of pulp capping with calcium hydroxide-based materials, failure rates increased with follow-up time.[9] In addition, an increased frequency of inflammatory cells and localized areas of pulp necrosis have also been reported.[10] Similar findings were found in our study where 7 clinical failures at 8 months and 5 clinical failures at 12 months were reported in teeth treated with calcium hydroxide (Dycal). This could be due to known disadvantages of gradual disintegration and tunnel defects in the newly formed dentin. [11]

In present study, two materials, self-cured calcium hydroxide (dycal) and light cured calcium hydroxide (prevest cal lc) were used as indirect pulp capping in children of age 4-8 years of age. children from 4-8 years of age were selected taking into consideration the lack of cooperation of children of <4 years and physiologic root resorption above the 9 years of age.[12]

Because of certain limitations of traditional material, recent work has tended to investigate new materials such as light cure calcium silicate and calcium hydroxide based cements such as Theracal LC, Prevest cal LC and mineral trioxide aggregate (MTA), Biodentine with the goal of replicating the biological advantages of calcium hydroxide without its mechanical and clinical deficiencies. Menon et al (2023)[13] evaluated three materials (Self-cured Ca(OH)2–Dycal ,Theracal and light-cured Ca(OH)2- Prevest Cal LC) for calcium ion releasing and The results of this study showed that the resin portion in the light cured Ca(OH)2 cement can promote calcium and OH ion release within the the dentin and favoured the interaction with the hydrophilic tooth dentin. the calcium ion release of light-cured Ca(OH)2 cements was found to be higher in all time periods of study than self-cured Ca(OH)2. A study done by Nowicka et al. (2013) [14] in which they compared human teeth treated with light cure pulp capping agent and calcium hydroxide (Dycal) in a histological model. The researchers found that both materials promoted dentin bridge formation, but the one formed under light cured cement was more continuous and showed better quality.

In the present study, Self cure calcium hydroxide and light cure calcium hydroxide was used as pulp capping agent primary molars and the intragroup comparison of clinical parameters over a 12-month period revealed a progressive decline in clinical success in both groups, though Group 2 consistently demonstrated better outcomes across most criteria suggesting more favourable pulpal response and restoration longevity. at 4 month

interval both the groups demonstrated 100% success, while at 8 month interval success of clinical outcome was 94.73% and 81.1% in group 1 and group 2 respectively. At the end of 12 month follow up period the success rate was 85.71% and 97.29% in group 1 and group 2 and the difference was statistically significant. ($p<0.05$)

A permanent restoration can be used instead of an SSC when the tooth is not significantly decayed. Previous studies revealed that a wide variety of materials were used to restore primary teeth following vital pulp therapies. Gruythuysen et al. (2010) [15] evaluated the outcomes of vital pulp therapy in primary molars and found that teeth restored with stainless steel crowns had a success rate of 92%, compared to 67% in those restored with composite or amalgam. The authors attributed the superior results to the full coverage and better marginal seal provided by SSCs, recommending their use to improve long-term success following pulpotomy.

Failures in IPC may be related to the remaining dentin thickness (RDT) overlying the pulp where studies reported that dentin- pulp complex response is affected by two factors, the RDT and the depth of bacterial penetration, where the thicker the remaining dentin, the lower the pulpal reaction. In the current study, RDT was not measured which might be acknowledged in future investigations.[7]

V. Conclusion

Based on the findings of the present study and considering the limitations of conventional pulp capping materials, it can be concluded that light-cure calcium hydroxide cements offer a reliable alternative for indirect pulp capping in deep carious lesions. Their ease of application, improved physical properties, and enhanced sealing ability support their clinical use. However, long-term clinical trials are recommended to further validate their effectiveness.

Limitations And Future Perspective

Limitations of this research include a small sample size and a short follow-up period, which may affect the generalizability of the findings. Future studies should incorporate larger sample sizes and extended follow-up durations to validate these results. Additionally, the study focused solely on clinical and radiographic parameters, which may not comprehensively reflect treatment success or failure. Future investigations should consider incorporating additional outcome measures and advanced imaging techniques to overcome the limitations of conventional 2D periapical radiographs.

Refrences

[1] Momeni-Moghaddam M, Hashemi C, Fathi A, Khamesipour F. Diagnostic Accuracy, Available Treatment, And Diagnostic Methods Of Dental Caries In Practice: A Meta-Analysis. Beni-Suef University Journal Of Basic And Applied Sciences. 2022 May 4;11(1):62.

[2] Fuks AB, Eidelman E. Pulp Therapy In The Primary Dentition. Curr Opin Dent. 1991 Oct;1(5):556–63.

[3] Bogen G, Kim JS, Bakland LK. Direct Pulp Capping With Mineral Trioxide Aggregate: An Observational Study. J Am Dent Assoc. 2008 Mar;139(3):305 15; Quiz 305–15.

[4] Kotsanos N, Arizos S. Evaluation Of A Resin Modified Glass Ionomer Serving Both As Indirect Pulp Therapy And As Restorative Material For Primary Molars. Eur Arch Paediatr Dent. 2011 Jun;12(3):170–5.

[5] Zander HA. Reaction Of The Pulp To Calcium Hydroxide. J Dent Res. 1939 Aug;18(4):373–9.

[6] Hashem D, Mannocci F, Patel S, Manoharan A, Brown JE, Watson TF, Et Al. Clinical And Radiographic Assessment Of The Efficacy Of Calcium Silicate Indirect Pulp Capping: A Randomized Controlled Clinical Trial. J Dent Res. 2015 Apr;94(4):562–8.

[7] Yu Y, Hao S, Jin Y, Zhang Q, Wang Y, Zou J. Potential Factors Affecting The Success Rate Of Indirect Pulp Therapy In Primary Molars With Deep Caries: A Retrospective Study. J Doi:10.22514/Jocpd.2024.058 Clin Pediatr Dent. 2024;48(3):46-51.

[8] Marchi JJ, De Araujo FB, Fröner AM, Straffon LH, Nör JE. Indirect Pulp Capping In The Primary Dentition: A 4 Year Follow-Up Study. J Clin Pediatr Dent. 2006;31(2):68–71.

[9] Fitzgerald M. Cellular Mechanics Of Dentinal Bridge Repair Using 3H-Thymidine. J Dent Res 1979;58:2198-206.

[10] Accorinte ML, Loguercio AD, Reis A, Carneiro E, Grande RH, Murata SS, Et Al. Response Of Human Dental Pulp Capped With MTA And Calcium Hydroxide Powder. Oper Dent 2008;33:488-95.

[11] Mathur, Vijay Prakash; Dhillon, Jatinder Kaur1; Logani, Ajay; Kalra, Gauri. Evaluation Of Indirect Pulp Capping Using Three Different Materials: A Randomized Control Trial Using Cone-Beam Computed Tomography. Indian Journal Of Dental Research 27(6):P 623-629, Nov–Dec 2016. | DOI: 10.4103/0970-9290.199588

[12] Daito M, Kawahara S, Kato M, Okamoto K, Imai G, Hieda T. Radiographic Observations On Root Resorption In The Primary Dentition. J Osaka Dent Univ. 1991;25(1):1-23.

[13] Menon SS, Sanghvi Z, Chokshi S, Patel P, Trivedi P, Patel N. Light-Cured Calcium Hydroxide Cements Release Of Calcium Ions Using Argon Based Induction Coupled Mass Spectroscopy - An In Vitro Study. Med Gas Res. 2023;13(1):29-32.

[14] Nowicka A, Lipski M, Parafiniuk M, Et Al. Response Of Human Dental Pulp Capped With Biodentine And Mineral Trioxide Aggregate. J Endod. 2013;39(6):743-747. Doi:10.1016/J.Joen.2013.01.005

[15] Gruythuysen RJM, Van Strijp AJP, Wu MK. Long-Term Survival Of Indirect Pulp Treatment Performed In Primary And Permanent Teeth With Clinically Diagnosed Deep Carious Lesions. J Endod. 2010 Sep;36(9):1490–3.