



www.bioinformation.net  
Volume 22(3)

Research Article

Received March 1, 2026; Revised March 31, 2026; Accepted March 31, 2026, Published March 31, 2026

DOI: 10.6026/973206300221802

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478

2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

**Declaration on Publication Ethics:**

The author's state that they adhere with COPE guidelines on publishing ethics as described elsewhere at <https://publicationethics.org/>. The authors also undertake that they are not associated with any other third party (governmental or non-governmental agencies) linking with any form of unethical issues connecting to this publication. The authors also declare that they are not withholding any information that is misleading to the publisher in regard to this article.

**Declaration on official E-mail:**

The corresponding author declares that lifetime official e-mail from their institution is not available for all authors

**License statement:**

This is an Open Access article which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. This is distributed under the terms of the Creative Commons Attribution License

**Comments from readers:**

Articles published in BIOINFORMATION are open for relevant post publication comments and criticisms, which will be published immediately linking to the original article without open access charges. Comments should be concise, coherent and critical in less than 1000 words.

**Disclaimer:**

Bioinformation provides a platform for scholarly communication of data and information to create knowledge in the Biological/Biomedical domain after adequate peer/editorial reviews and editing entertaining revisions where required. The views and opinions expressed are those of the author(s) and do not reflect the views or opinions of Bioinformation and (or) its publisher Biomedical Informatics. Biomedical Informatics remains neutral and allows authors to specify their address and affiliation details including territory where required.

Edited by P Kanguane

Citation: Soni *et al.* Bioinformation 22(3): 1802-1805 (2026)

# Comparative evaluation of MTA and PRF for direct pulp capping in permanent mandibular molars - A randomized control trial

Niharika Soni, Poonam Bogra, Swati Chhabra\*, Nikita Goyal, Himani Arora & Pooja Bala

Department of Conservative Dentistry and Endodontics, J.N. Kapoor DAV Centenary Dental College and Hospital, Yamunanagar, Haryana, India; \*Corresponding author

**Affiliation URL:**

<http://www.davdentalyrn.com/>

**Author contacts:**

Niharika Soni - E-mail: [niharika.soni725@gmail.com](mailto:niharika.soni725@gmail.com)

Poonam Bogra - E-mail: [poonambogra@yahoo.in](mailto:poonambogra@yahoo.in)

Swati Chhabra - E-mail: endoswatichabra@gmail.com; Phone: +91 9034743780

Nikita Goyal - E-mail: nktagyl1995@gmail.com

Himani Arora - E-mail: ahimani35@gmail.com

Pooja Bala - E-mail: pbdentalcare@gmail.com

### Abstract:

Direct pulp capping (DPC) aims to encourage pulp healing and the development of a mineralized tissue barrier and its successful implementation prevents the need for extensive treatment by protecting the exposed pulp with a dental biomaterial. Therefore, it is of interest to evaluate and compare the clinical outcome, radiographic outcome, pain score and analgesic intake after Direct Pulp Capping (DPC) using Mineral Trioxide Aggregate (MTA) and Platelet Rich Fibrin (PRF) as pulp capping agents in cariously exposed permanent mandibular molars with reversible pulpitis. Hence, a total of 154 permanent mandibular molars following the inclusion exclusion criteria were selected for the study. Teeth were randomly divided into two groups (Group I and II) of 77 teeth each. DPC was done with MTA and PRF in groups I and II respectively. All the samples were then evaluated at 1, 3, 6 and 12 months postoperatively. On statistical evaluation a significant difference was found between Group I (MTA) and Group II (PRF) at 6 and 12 months follow-up period. PRF showed a higher success rate and less postoperative pain than MTA at all intervals, indicating its strong potential as a superior direct pulp capping material.

**Keywords:** Direct Pulp Capping (DPC), Electric Pulp Testing (EPT), Mineral Trioxide Aggregate (MTA), Platelet Rich Fibrin (PRF), Sodium Hypochlorite (NaOCl)

### Background:

Root canal treatment (RCT) is a reliable option for managing pulpal pathologies; however, recent evidence suggests that DPC is effective in managing deep carious lesions with reversible pulpitis [1]. DPC involves the placement of a biocompatible material directly over an exposed vital pulp due to caries, trauma, or operative procedures to promote healing and dentin bridge formation [2]. Historically, calcium hydroxide has been the material of choice due to its ability to stimulate reparative dentin. However, the resulting dentin bridge is often porous and insufficiently seals the pulp, leading to a high risk of failure [3, 4]. To address this, Mineral Trioxide Aggregate (MTA), a bioceramic material has been widely adopted [5]. MTA demonstrates superior biocompatibility, bioactivity and sealing ability and stimulates dentinogenesis via progenitor cell differentiation [6]. However, drawbacks such as discoloration, toxicity due to presence of arsenic, long setting time, difficult handling and higher cost limit its use [5]. Recently, biological alternatives like Platelet-Rich Fibrin (PRF) have been explored. PRF, a second-generation autologous platelet concentrate, promotes stem cell recruitment, angiogenesis and mineralization through the sustained release of growth factors [7]. Therefore, it is of interest to evaluate the clinical and radiographic outcomes of MTA and PRF as direct pulp capping agents in cariously exposed permanent mandibular molars with reversible pulpitis.

### Materials and Methodology:

This randomized controlled trial was conducted to evaluate and compare the effectiveness of MTA and PRF as Direct Pulp capping agents. The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000 Ethical approval was obtained from the Institutional Ethical Committee (Reference no. F/IEC/23/0298). Written informed consent was obtained from the participants prior to investigation. Patients

aged 18 to 50 years with permanent mandibular first or second molars exhibiting deep occlusal caries and diagnosed with reversible pulpitis were included in the study. Only systemically healthy individuals without any radiographic signs of periapical pathology were selected. Teeth had to be restorable with composite resin and amenable to rubber dam isolation. Exclusion criteria included teeth diagnosed with irreversible pulpitis or necrosis, those with clinical signs like tenderness on percussion, sinus tract, mobility, or periapical radiolucency, pregnant or lactating women, patients with NSAID allergies and teeth where pulp was not exposed on caries excavation or bleeding could not be controlled within 10 minutes using 3% sodium hypochlorite. Based on a reported 85% success rate for MTA<sup>1</sup> and an expected 15% relative difference for PRF ( $\approx 13\%$  absolute difference), the sample size was calculated with a 5% significance level (two-tailed) and 80% power. After adjusting for a 10% loss to follow-up, the final sample size was 77 participants per group. A total of 154 teeth diagnosed with reversible pulpitis were randomly allocated into two groups (Group I and Group II) of 77 teeth each using a computer-generated randomization sequence. After administering local anaesthesia, isolation was achieved using rubber dam and the tooth was disinfected with 2% chlorhexidine. Caries removal was done under 3x magnification using carbide burs and spoon excavators with the help of caries detector dye. Haemostasis was achieved using 3% sodium hypochlorite soaked cotton pellet. If haemostasis was not achieved within 10 minutes, the tooth was excluded from the study. In Group I, MTA Angelus was mixed with distilled water and placed over the exposure site, followed by temporary sealing. After setting of the cement, the cavity was lined with GIC and restored using nano-ceramic composite resin. In Group II, A-PRF Plus was prepared from 10 ml of venous blood via centrifugation (1300 rpm, 8 min) and placed over the exposure. The cavity was then restored similarly with RMGIC and composite. Patients were advised to take Piroxicam 20 mg for pain if needed and patients were asked to record pain

scores on VAS scale. RCT was performed in cases of unresolved symptoms. Clinical and radiographic follow up examination was done at 4 days, 1, 3, 6 and 12 months. On clinical evaluation spontaneous pain/ referred pain, post-operative sensitivity greater than 15 seconds, tenderness on percussion and loss of pulp vitality were considered as failure. On radiographic evaluation periapical radiolucency or PDL widening were considered as failure. Post-operative pain evaluation was done after 6, 12, 24 hours, 2 and 3 days. Analgesics consumed during 3 days postoperatively were recorded on the 4<sup>th</sup> day.

### Statistical evaluation:

Descriptive statistics was performed by calculating mean and standard deviation for the continuous variables. Categorical variables were presented as absolute numbers and percentage. The success rates were compared using chi-square test. The pain scores and analgesic intake were compared using Mann-Whitney U test.

### Results:

The clinical success rates were found to decrease from 90.1% in Group I (MTA) and 97.4% in Group II (PRF) at 4 days to 67.5% in Group I and 85.7% in Group II at 12 months. A significant difference was found between Group I and Group II at 6 and 12 months ( $p < 0.05$ ) (Table 1). On radiographic evaluation success rates were found to decrease from 98.7% in Group I and 100% in Group II at 4 days to 93.5% and 97.4% in Group I and II respectively at 12 months. There was no significant difference found between the two groups ( $p > 0.05$ ) (Table 2).

**Table 1:** Comparative evaluation of the success proportion between Group I (MTA) and Group II (PRF) at various time intervals

Follow-up time	Group I (MTA) (n =77)	Group II (PRF) (n = 77)	P-value
4 <sup>th</sup> day	70(90.1%)	75(97.40%)	0.835
1-month	60(77.9%)	68(88.3%)	0.425
3-months	54(70.1%)	66(85.7%)	0.100
6-months	52(67.5%)	66(85.7%)	0.040
12-months	52(67.5%)	66(85.7%)	0.040

**Table 2:** Comparative evaluation of radiographic success proportion between Group I (MTA) and Group II (PRF)

Follow-up time	Group I (MTA) [n=77]	Group II (PRF) [n=77]	P-value (Bonferroni adjusted)
4 <sup>th</sup> days	76 (98.7%)	77(100%)	1.00
1-month	75 (97.4%)	76(98.7%)	1.00
3-months	73 (94.8%)	75 (97.4%)	1.00
6-months	72 (93.5%)	75 (97.4%)	1.00
12-months	72 (93.5%)	75 (97.4%)	1.00

### Discussion:

Direct Pulp Capping (DPC) offers a conservative, minimally invasive alternative aimed at preserving pulp vitality [8]. Permanent mandibular molars were chosen due to their larger pulp volume and better collateral circulation, which enhance healing potential and contribute to higher success rates [9]. When compared to Group I, Group II consistently showed higher success rates, with statistically significant differences at 6 and 12 months ( $p = 0.04$ ). The observed differences in outcomes

between MTA and PRF can be attributed to their distinct mechanisms of action as MTA promotes dentin bridge formation through reparative biochemical pathways, while PRF, as a biologically active scaffold, supports true pulp tissue regeneration via the sustained release of autologous growth factors [7]. MTA, despite being effective, has limitations such as initial cytotoxicity due to its high pH, handling difficulties and compromised sealing ability due to calcium hydroxide release during setting [9]. In contrast, PRF is fully biocompatible and autologous, with no cytotoxicity [10, 11]. PRF contains platelets and leukocytes within a fibrin matrix, releasing key growth factors (e.g., TGF- $\beta$ 1, VEGF, PDGF, EGF, IGF-1) and cytokines (IL-1 $\beta$ , IL-6, IL-4, TNF- $\alpha$ ), which play vital role in pulp healing, angiogenesis and tissue regeneration [12, 13]. PRF's anti-inflammatory effects, facilitated by leukocytes, cytokines and fibrin, contributed to faster pain reduction. MTA has been shown to have limited antimicrobial activity, potentially impacting its healing performance [14, 15]. According to Tiwari *et al.* PRF when compared with MTA, is a suitable substitute material for DPC of primary teeth and can be classified as a promising therapeutic biomaterial [16]. However, limitations of the study include the inability to blind the operator, a relatively short 12-month follow-up, lack of CBCT or histologic analysis and reliance on subjective bleeding time for pulp assessment. Future studies with larger sample sizes, longer follow-up and advanced diagnostics are needed to validate these findings.

### Conclusion:

The study comparing PRF and MTA for direct pulp capping revealed that PRF achieved significantly higher success rates at both 6 and 12 months. Patients treated with PRF also reported significantly less postoperative pain and less analgesic intake at all evaluated time intervals compared to those treated with MTA. These findings indicate that PRF not only provides superior clinical and patient-centered outcomes but also shows a strong potential to serve as a promising alternative to MTA, the current gold standard for direct pulp capping. Thus, advancement in knowledge regarding pulpotomy is the shift towards regenerative biomaterials to promote the healing of remaining radicular pulp.

### References:

- [1] Cushley S *et al.* *Int Endod J.* 2021 **54**:556. [PMID: 33222178]
- [2] Song M *et al.* *J Endod.* 2015 **41**:11. [PMID: 25443279]
- [3] Motwani N *et al.* *J Conserv Dent.* 2021 **24**:124. [PMID: 34759576]
- [4] Hatipoglu O *et al.* *J Dent.* 2025 **162**:106073. [PMID: 40886932].
- [5] Kusum B *et al.* *Restor Dent Endod.* 2015 **40**:276. [PMID: 26587413]
- [6] Suhag K *et al.* *J Endod.* 2019 **45**:840. [PMID: 31104819]
- [7] Shobana S *et al.* *Eur Endod J.* 2022 **7**:114. [PMID: 35786576]
- [8] Colloc TNE & Tomson PL, *Br Dent J.* 2025 **238**:458. [PMID: 40217028]
- [9] Horsted P *et al.* *Endod Dent Traumatol.* 1985 **1**:29. [PMID: 3858095]

- [10] Chhabra S *et al.* *Endodontology*. 2023 **35**:273. [DOI: 10.4103/endo.endo\_271\_22]
- [11] Rao A *et al.* *J Clin Pediatr Dent*. 2009 **34**:1. [PMID: 19953801]
- [12] Goel P *et al.* *Bioinformation*. 2024 **31** **20**:785. [PMID: 39309555]
- [13] Narayanaswamy R *et al.* *Bioengineering (Basel)*. 2023 **10**:58. [PMID: 36671630]
- [14] Pavlovic V *et al.* *Open Med (Wars)*. 2021 **16**:446 [PMID: 33778163]
- [15] Islam R *et al.* *Jpn Dent Sci Rev*. 2023 **59**:48. [PMID: 36880059]
- [16] Tiwari T *et al.* *Int J Clin Pediatr Dent*. 2024 **17**:S25. [PMID: 39185252]
- 

*Caveat Emptor is applicable among the literate community where required and possible. The publisher, its journal, editors and the internal/external reviewers take adequate steps to check, evaluate, correct, edit, revise and improve content where possible and required.*