

Third Generation Platelet Concentrate and Mineral Trioxide Aggregate as Therapeutic Agents for Pain Assessment of Teenagers Teeth: A Randomized Controlled Trial

Mahmoud Mostafa Abdelhakim¹, Mahmoud Ahmed Abdelmotelb²

1 Assistant Lecturer of Pediatric and community dentistry, faculty of Dentistry Minia University.

2 Lecturer of Pediatric and Community Dentistry, Faculty of Dentistry Minia University

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ABSTRACT

Aims: This randomized controlled trial aimed to compare cumulative postoperative in adolescents following Pulpotomy for pulpitis using Third generation Platelet Concentrate versus mineral trioxide aggregate (MTA).

Results: Third generation Platelet Concentrate (concentrated growth factor), CGF, produced a faster and more pronounced reduction in postoperative pain, especially during the first few days.

Conclusions: Third generation Platelet Concentrate was superior to MTA in controlling early postoperative pain but both agents are effective for pain control.

Keywords: Postoperative pain; Third generation Platelet Concentrate, MTA.

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INTRODUCTION

Clinical symptoms are usually used to diagnose irreversibly inflamed pulp, which is described as tissue that has lost its ability to recover and requires root canal therapy. Nonetheless, histological and microbiological data consistently show that the coronal pulp is frequently the primary location of the related inflammation and microbial colonization (Taha et al., 2022).

An improved knowledge of pulp biology and the creation of sophisticated bioactive capping materials serve as the foundation for the move toward minimal intervention (Bjorndal, 2019). For older teeth with symptomatic irreversible pulpitis (SIP), vital pulp therapy (VPT), and more especially pulpotomy, has become a feasible substitute for traditional root canal therapy (RCT) (Alfaisal et al., 2024). This method provides and more economical operation than classic RCT by specifically removing the inflammatory coronal pulp (Eren et al., 2018).

Even while VPT with MTA has good clinical results, better regeneration might be possible with a treatment that more closely resembles natural wound healing.

Consequently, a dense fibrin matrix enriched with platelets, leukocytes, and various growth factors like transforming growth factor- β (TGF- β), platelet-derived growth factor (PDGF), and vascular endothelial growth factor (VEGF) is provided by Concentrated Growth Factors (CGF), an autologous platelet concentrate (Li et al., 2025). According to Inchingolo et al. (2024), these bioactive compounds aid in angiogenesis, tissue healing, and progenitor cell recruitment and differentiation.

In addition to serving as a reservoir for the continuous release of growth factors, the third generation platelet

concentrate fibrin network offers an advantageous scaffold that improves wound healing, encourages dentin-pulp complex regeneration, lowers the risk of immunological reactions, and supports pulp survival (Elheeny and Tony, 2024).

MATERIALS AND METHODS

Ethical approval

The clinical trial registered on ClinicalTrials.gov on August 17, 2025. Informed consent was obtained from the parents or legal guardians of all participants. The treatment procedures, potential outcomes, possible complications, and required follow-up actions were clearly explained before treatment initiation.

Sample calculation

A sample of 54 subjects (27 per group) was accounted after adding a 15% attrition rate.

Eligibility of participation

Inclusion criteria

Patient-based criteria: Class ASA I or II cooperative adolescents of 11 — 17 years. Based on a 10 cm modified visual analog scale (VAS), only patients who reported a preoperative pain intensity score of ≥ 7 , indicative of severe pain (Emara et al., 2021), were included.

Treatment protocol

Preoperative pain intensity assessment

Before starting pulpotomy procedures, each patient was asked to record the intensity of pain level on modified VAS scale (only patients with high scores indicating severe preoperative intensity were included)

Pulpotomy procedures

Single clinician with ten years of experience performed endodontic procedures. Inferior alveolar nerve block

*Author for Correspondence: Mahmoud Mostafa Abdelhakim

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(IANB) technique with 4% articaine with 1:200,000 epinephrine (Septanest, Septodont, France) to anesthetize the side of carious molar. Rubber dam clamps were applied and teeth were isolated. After confirming the effectiveness of anesthesia, demineralized tissues were totally excavated from the walls first using sharp spoon excavator (Maillefer, Dentsply Sirona, Ballaigues, Switzerland) or large round carbide bur at low speed. Once the pulp was exposed, the cavity was rinsed with 2.5% sodium hypochlorite (NaOCl) (Taha and Abdulkhader, 2018, Linsuwanont et al., 2017). With the aid of a carbide bur no. 245 (Dentsply Maillefer, Tulsa, OK, USA) and Endo-Z bur, the access cavity was gained and complete deroofing was performed. After pulpotomy procedures both MTA and Third generation platelet concentrate were applied.

Trial outcomes

The trial outcome was to compare the cumulative pain responses using modified VAS scores.

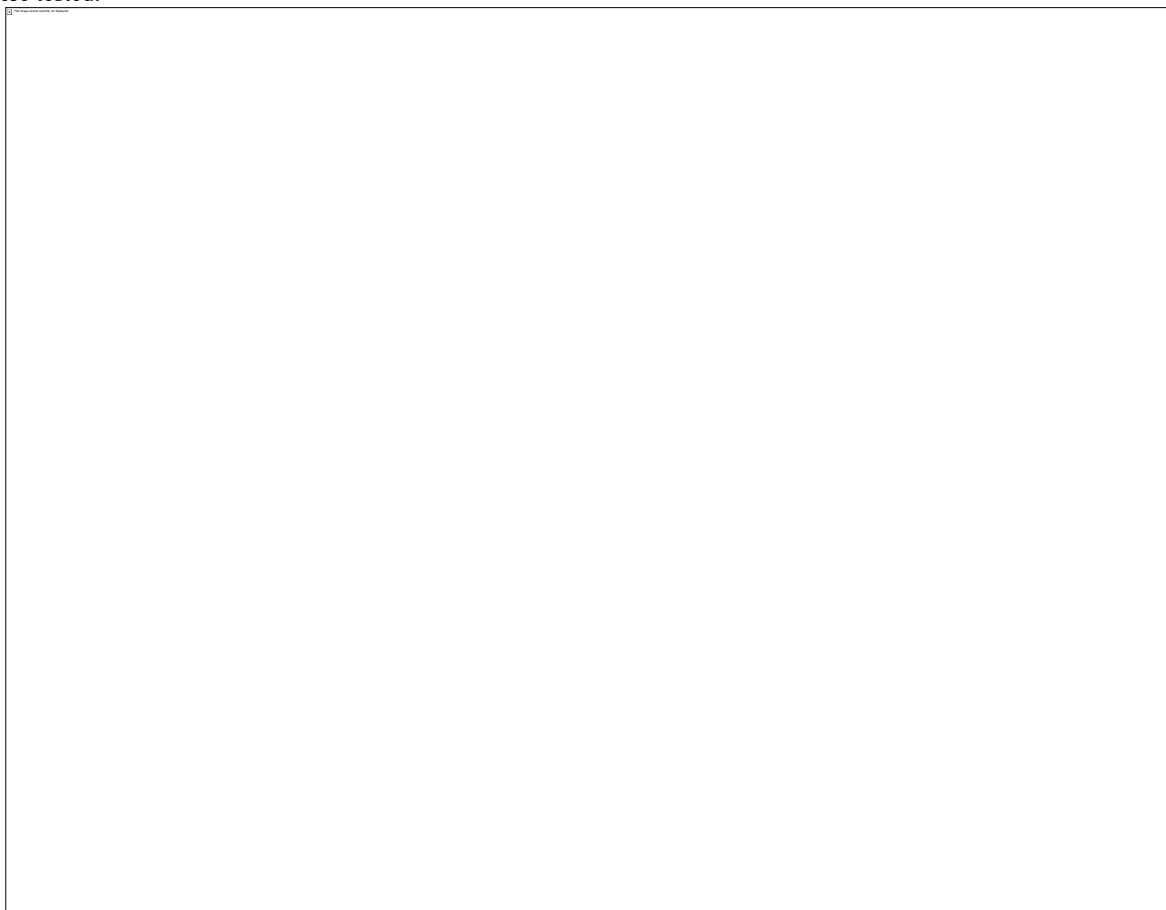
STATISTICAL ANALYSIS

Descriptive data in terms of gender and pain presence or absence were analyzed using chi-square test and Fisher's exact test. After testing the normality by employing Shapiro-Wilk Test, the participant's age, VAS pain scores were tested.

RESULTS

Fifty-four participants were included after initial screening of 67 subjects for eligibility. With no missed records, VAS forms were collected from 10 males and 17 females in the Third generation platelet concentrate group (mean age = 14.07 ± 1.62 years) and 12 males and 15 females in the MTA group (mean age = 13.89 ± 1.53 years). as shown in Table 1.

The distribution of postoperative pain intensities differed significantly between the CGF and MTA groups during the early postoperative period. On Days 1 and 2, the CGF group demonstrated a markedly higher proportion of pain free patients, whereas the MTA group exhibited substantially greater percentages of mild, moderate, and severe pain (Day 1: $P = 0.024$; Day 2: $P = 0.033$). This pattern persisted on Day 3, with the CGF group continuing to show a more favorable pain profile compared with the MTA group ($P = 0.024$). By Day 7, pain had nearly resolved in both groups, and the difference in pain distribution was no longer statistically significant ($P = 0.115$). Overall, CGF promoted a faster and more pronounced reduction in postoperative pain relative to MTA, particularly during the first three postoperative days (Figure 1).



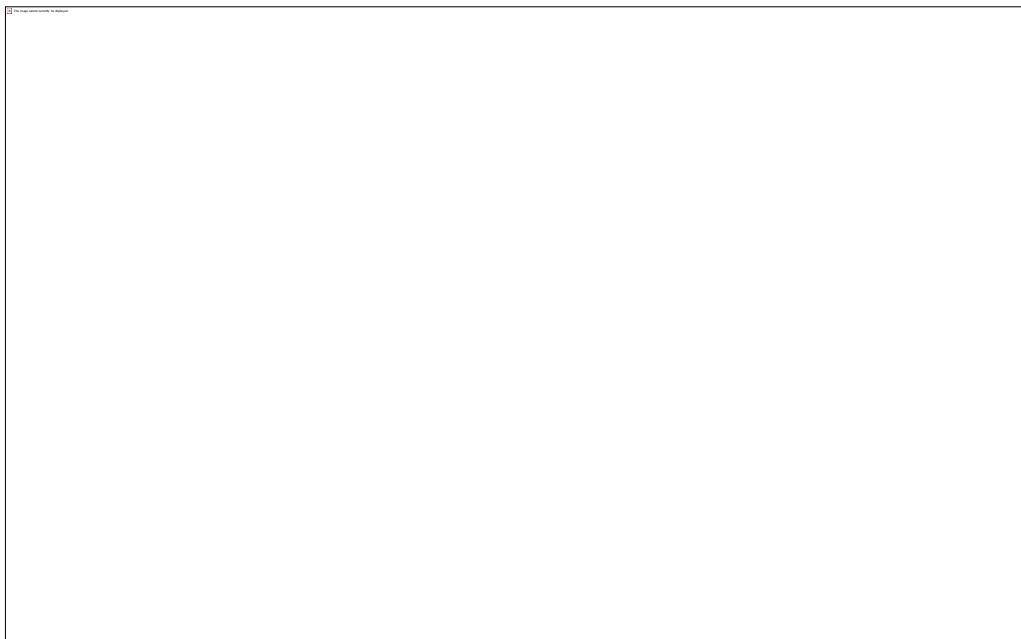


Figure 1. Distribution of visual analogue scale pain intensities throughout the follow- up periods

DISCUSSION

Currently, no evidence suggests that the time to achieve hemostasis affects pulpotomy outcomes. However, in line with previous literature, we performed root canal treatment in cases where pulpal bleeding could not be controlled within a 5–10 minutes (Duncan et al., 2023). Based on the AAE position statement, NaOCl—regardless of concentration—was safely employed for hemostasis and disinfection of the contaminated wound. Its use did not compromise key regenerative processes, including cellular recruitment, differentiation, and calcified tissue formation (AAE, 2021, Bogen et al., 2008).

The incidence of pain absence after pulpotomy with CGF and MTA on postoperative days one through three was 70.4% ($n = 38/54$), 75.9% ($n = 41/54$), and 79.6% ($n = 43/54$), respectively, with patients treated with CGF reporting significantly lower pain levels. After one week, pain was absent in 92.6% of patients ($n = 50/54$), with no significant difference between the two groups. Thus, the findings emphasize that the curtail type of pulp capping approach in early postoperative pain outcomes following pulpotomy for SIP. In agreement with a recent cross-sectional study that investigated 17 different inflammatory biomarkers for their correlation with pulp condition (Sabeti et al., 2026). The preoperative load of IL-8 was one of the significantly increased inflammatory proteins in case of SIP and apical periodontitis especially when the VAS scores were more than 5. Furthermore, the levels of NKA, SP, IL-8, and MMP8 were high in samples obtained from CGF of patients with SIP who reported VAS scores more than 6 (Dincer et al., 2020). This was consistent with the current findings and confirmed the significant association between high pain intensity and IL-8 proinflammatory proteins. The proinflammatory action of IL-8 is attributed to its

chemokine ability to trigger innate immune response via activation and recruitment of neutrophils to inflammatory site (Zehnder et al., 2003, Sabeti et al., 2026).

CONCLUSIONS

Both third generation platelet concentrate and MTA can control pain in the treated teeth the superiority was for third generation platelet concentrate but without significant difference

REFERENCES

1. Taha, N. A., Al-Rawash, M. H. & Imran, Z. A. 2022. Outcome Of Full Pulpotomy In Mature Permanent Molars Using 3 Calcium Silicate-Based Materials: A Parallel, Double Blind, Randomized Controlled Trial. *Int Endod J*, 55, 416-429.
2. Bjorndal, L. 2019. Is Pulpotomy Preferable to Root Treatment Where There Is Pulp Exposure? *Evid Based Dent*, 20, 117-118.
3. Alfaisal, Y., Idris, G., Peters, O. A., Zafar, S., Nagendrababu, V. & Peters, C. I. 2024. Vital Pulp Therapy-Factors Influencing Decision-Making for Permanent Mature Teeth with Irreversible Pulpitis: A Systematic Review. *Int Endod J*, 57, 505-519.
4. Eren, B., Onay, E. O. & Ungor, M. 2018. Assessment Of Alternative Emergency Treatments for Symptomatic Irreversible Pulpitis: A Randomized Clinical Trial. *Int Endod J*, 51 Suppl 3, E227-E237.
5. Li, Y., Sui, B., Dahl, C., Bergeron, B., Shipman, P., Niu, L., Chen, J. & Tay, F. R. 2019. Pulpotomy For Carious Pulp Exposures in Permanent Teeth: A

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- Systematic Review and Meta-Analysis. *J Dent*, 84, 1-8.
6. Inchingolo, F., Inchingolo, A. M., Latini, G., De Ruvo, E., Campanelli, M., Palermo, A., Fabbro, M. D., Blasio, M. D., Inchingolo, A. D. & Dipalma, G. 2024. Guided Bone Regeneration: CGF And PRF Combined with Various Types of Scaffolds-A Systematic Review. *Int J Dent*, 2024, 4990295.
7. Elheeny, A. A. H. & Tony, G. E. 2024. Two-Dimensional Radiographs and Cone-Beam Computed Tomography Assessment of Concentrated Growth Factor and PlateletRich Fibrin Scaffolds In Regenerative Endodontic Treatment of Immature Incisors with Periapical Radiolucency: A Randomized Clinical Trial. *J Endod*, 50, 792-806.
8. Emara, R. S., Gawdat, S. I. & El-Far, H. M. M. 2021. Effect Of XP-Endo Shaper Versus Conventional Rotary Files On Postoperative Pain and Bacterial Reduction in Oval Canals with Necrotic Pulps: A Randomized Clinical Study. *Int Endod J*, 54, 1026-1036.
9. Ali, A., Olivieri, J. G., Duran-Sindreu, F., Abella, F., Roig, M. & Garcia-Font, M. 2016. Influence Of Preoperative Pain Intensity on Postoperative Pain After Root Canal Treatment: A Prospective Clinical Study. *J Dent*, 45, 39-42.
10. Duncan, H. F., El-Karim, I., Dummer, P. M. H., Whitworth, J. & Nagendrababu, V. 2023. Factors That Influence the Outcome of Pulpotomy in Permanent Teeth. *Int Endod J*, 56 Suppl 2, 62-81.
11. Bogen, G., Kim, J. S. & Bakland, L. K. 2008. Direct Pulp Capping with Mineral Trioxide Aggregate: An Observational Study. *J Am Dent Assoc*, 139, 305-15; Quiz 305-15.
12. AAE Position Statement on Vital Pulp Therapy. 2021. *J Endod*, 47, 1340-1344. Akbal Dincer, G., Erdemir, A. & Kisa, U. 2020. Comparison Of Neurokinin A, Substance P, Interleukin 8, And Matrix Metalloproteinase-8 Changes in Pulp Tissue and Gingival Crevicular Fluid Samples of Healthy and Symptomatic Irreversible Pulpitis Teeth. *J Endod*, 46, 1428-1437.
13. Sabeti, M. A., Nikghalb, K., Pakzad, R. & Fouad, A. F. 2026. The Relationship Between Pulpal Diagnostic Conditions and Potential Inflammatory Biomarkers. *Int Endod J*, 59, 23-37.
14. Dincer, G. A., Erdemir, A. & Kisa, U. 2021. Erratum To Comparison of Neurokinin A, Substance P, Interleukin 8, And Matrix Metalloproteinase-8 Changes in Pulp Tissue and Gingival Crevicular Fluid Samples Of Healthy and Symptomatic Irreversible Pulpitis Teeth [*J Endod* 46 (2020) 1428-1437]. *J Endod*, 47, 339.
15. Zehnder, M., Delaleu, N., Du, Y. & Bickel, M. 2003. Cytokine gene expression--part of host defence in pulpitis. *Cytokine*, 22, 84-8.