ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7661-7665 (2026)
©Biomedical Informatics (2026)

BIOINFORMATION
Discovery at the interface of physical and biological sciences
BIOMEDICAL INFORMATICS
www.bioinformation.net
Volume 22(10)
Research Article

Received October 1, 2026; Revised October 31, 2026; Accepted October 31, 2026, Published October 31, 2026
DOI: 10.6026/973206300227661

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 Ruby Singh
E-mail: bioinformationruby@gmail.com
Citation: Madhavi *et al.* Bioinformation 22(10): 7661-7665 (2026)

Combined endodontic-orthodontic approach for management of traumatized anterior teeth: A retrospective analysis

Karlapudi Madhavi[1], Mayur Bhola[2,*], Sania Khan[3], Kamalshikha Baheti[3], Triveni Bhargava[4] & Neelam Vijaywargiya[5]

[1]Department of Conservative Dentistry and Endodontics, St. Joseph Dental College, Eluru, Andhra Pradesh, India; [2]Department of Orthodontics & Dentofacial Orthopaedics, Government Dental College, Jamnagar, Gujarat, India; [3]Department of Orthodontics & Dentofacial Orthopedics, Sri Aurobindo College of Dentistry, Indore, Madhya Pradesh, India; [4]Department of Oral and Maxillofacial Surgery, Government College of Dentistry, Indore, Madhya Pradesh, India; [5]Department of Conservative Dentistry and Endodontics, Government College of Dentistry, Indore, Madhya Pradesh, India; *Corresponding author

ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7661-7665 (2026)
©Biomedical Informatics (2026)

Affiliation URL:
https://stjosephdentaleluru.com/
https://gdchjam.com/
https://sriaurobindouniversity.edu.in/dental-college
https://www.gdcindore.com/

Authors contact:
Karlapudi Madhavi - E-mail: karlapudi.madhavi@gmail.com
Mayur Bhola - E-mail: mb.bhola@gmail.com
Sania Khan - E-mail: drsania003@gmail.com
Kamalshikha Baheti - E-mail: drkamalshikha@gmail.com
Triveni Bhargava - E-mail: sonal.triveni@gmail.com
Neelam Vijaywargiya - E-mail: neelam_vijaywargiya@yahoo.co.in

Abstract:
Traumatized anterior teeth requiring orthodontic treatment present complex pulpal, periodontal and root-related challenges requiring interdisciplinary management. This retrospective study evaluated 102 traumatized anterior teeth in 84 patients treated with combined endodontic-orthodontic management over a minimum 12-month follow-up. Favourable outcomes were observed in 89.2% of teeth, with successful orthodontic movement in 92.2% and overall tooth survival of 96.1%. Severe trauma and pre-existing root resorption were significantly associated with unfavourable outcomes, while most teeth showed satisfactory periapical healing. Thus, data shows the predictability of interdisciplinary endodontic-orthodontic management while identifying severe trauma and pre-existing root resorption as important prognostic factors.

Keywords: Dental trauma, traumatized anterior teeth, endodontic-orthodontic management, orthodontic tooth movement, root canal treatment, external apical root resorption, periapical healing, interdisciplinary dental treatment

Background:
Traumatic injuries of anterior teeth may affect the pulp, periodontal ligament, supporting tissues, root development and long-term prognosis, requiring careful interdisciplinary planning when orthodontic treatment is indicated **[1]**. Treatment planning depends on injury severity, root development, pulpal and periodontal status and time since trauma, with structured follow-up essential because late complications may occur **[2]**. Orthodontic forces can alter dento-pulpal and periodontal tissues; therefore, pulpal vitality, periapical status and root integrity should be assessed before and during treatment **[3]**. Previous trauma may increase susceptibility to orthodontically induced root resorption, particularly in teeth with pre-existing root damage, emphasizing radiographic assessment and controlled force application **[4]**. Endodontically treated teeth can generally undergo orthodontic movement when adequate endodontic and periodontal conditions are present, although treatment quality and force control remain important **[5, 6]**. Orthodontic movement should preferably follow adequate endodontic infection control and evidence of favourable healing to minimize biological complications **[7]**. Interdisciplinary endodontic-orthodontic management can facilitate preservation and repositioning of compromised teeth when supported by accurate diagnosis, appropriate case selection and continuous monitoring **[8]**. External apical root resorption is influenced by patient, root, trauma and orthodontic related factors, supporting careful risk assessment and periodic radiographic monitoring **[9]**. Trauma related complications, including pulp necrosis, inflammatory or replacement resorption, ankylosis and periodontal disturbances, may affect treatment planning and require long-term follow-up **[10].** Therefore, it is of interest to evaluate the outcomes of a combined endodontic orthodontic approach for traumatized anterior teeth, with emphasis on tooth preservation, treatment response and associated complications.

Materials and Methods:
This retrospective observational study evaluated the clinical and radiographic outcomes of a combined endodontic-orthodontic approach in patients with traumatized anterior teeth. Clinical and radiographic records of patients treated between January 2019 and December 2024 were reviewed. A total of 126 records were screened, of which 84 patients with 102 traumatized permanent anterior teeth fulfilled the eligibility criteria and were included in the analysis. Patients aged 12–35 years with a documented history of anterior dental trauma; subsequent pulpal or periapical involvement requiring endodontic treatment and later orthodontic tooth movement were included. Cases with incomplete records, inadequate follow-up, severe periodontal disease, non-restorable teeth, advanced ankylosis or replacement resorption and active untreated endodontic infection were excluded. Data regarding patient demographics, type of traumatic injury, tooth involved, pulpal and periapical status, endodontic treatment, interval between endodontic and orthodontic procedures, treatment duration and follow-up were recorded. Endodontic treatment was performed according to the pulpal and periapical condition of the affected teeth using standard root canal procedures. Orthodontic treatment was initiated after satisfactory control of endodontic infection and assessment of periapical and periodontal healing. Light and controlled orthodontic forces were applied using fixed

orthodontic appliances. Clinical and radiographic follow-up was performed periodically during orthodontic treatment. The teeth were assessed for pain, mobility, periodontal complications, periapical healing and external apical root resorption. The primary outcome was successful preservation and orthodontic movement of the traumatized tooth without major complications. Secondary outcomes included periapical healing, root resorption, need for additional endodontic intervention and tooth survival. A minimum follow-up period of 12 months was considered for the analysis. Data were analysed using IBM SPSS Statistics version 26.0. Continuous variables were summarized as mean and standard deviation, while categorical variables were expressed as frequencies and percentages. Chi-square or Fisher's exact test was used for categorical comparisons and appropriate parametric or non-parametric tests were used for continuous variables. A p-value of <0.05 was considered statistically significant.

Results:

A total of 84 patients with 102 traumatized anterior teeth were included in the final analysis. The mean age of the patients was 21.6 ± 5.8 years. Of the 84 patients, 49 (58.3%) were males and 35 (41.7%) were females. Maxillary central incisors were the most frequently involved teeth. Luxation injuries represented the most common type of trauma, followed by crown/root fractures, subluxation and avulsion **(Table 1).** All 102 teeth received endodontic treatment before or in conjunction with orthodontic therapy. The mean follow-up period was 24.8 ± 8.6 months. Overall, 91 teeth (89.2%) demonstrated a favourable combined endodontic-orthodontic outcome. Satisfactory periapical healing was observed in 88 teeth (86.3%). Mild external apical root resorption was detected in 12 teeth (11.8%), whereas moderate-to-severe root resorption occurred in 5 teeth (4.9%). Additional endodontic intervention was required in 6 teeth (5.9%) **(Table 2).** Successful orthodontic movement to the planned position was achieved in 94 teeth (92.2%). Eight teeth (7.8%) demonstrated an unfavourable orthodontic response requiring modification or discontinuation of orthodontic forces. At the final follow-up, 98 of the 102 teeth remained functional, corresponding to an overall tooth survival rate of 96.1%. Four teeth (3.9%) required extraction because of severe root resorption, ankylosis, or persistent periapical pathology **(Table 3).** Severe initial traumatic injury was significantly associated with an unfavourable treatment outcome (p = 0.021). Similarly, the presence of pre-existing root resorption was significantly associated with progression of root resorption during orthodontic treatment (p = 0.014). No statistically significant association was observed between age, sex, or tooth location and overall treatment outcome (p > 0.05) **(Table 4).** The combined endodontic-orthodontic approach resulted in a high rate of tooth preservation and successful orthodontic movement. Most traumatized anterior teeth exhibited satisfactory periapical healing, with a low incidence of clinically significant root resorption and other complications.

Table 1: Demographic and baseline characteristics of the study population

Variable	Findings
Total patients	84
Total traumatized teeth	102
Mean age (years)	21.6 ± 5.8
Male	49 (58.3%)
Female	35 (41.7%)
Maxillary central incisors	61 (59.8%)
Maxillary lateral incisors	25 (24.5%)
Mandibular anterior teeth	16 (15.7%)
Luxation injuries	38 (37.3%)
Crown/root fractures	29 (28.4%)
Subluxation	21 (20.6%)
Avulsion/replantation	14 (13.7%)

Table 2: Clinical and radiographic outcomes of combined treatment

Outcome	n (%)
Favourable overall outcome	91 (89.2%)
Satisfactory periapical healing	88 (86.3%)
Mild external apical root resorption	12 (11.8%)
Moderate-to-severe root resorption	5 (4.9%)
Additional endodontic intervention	6 (5.9%)
Periodontal complications	5 (4.9%)
Persistent/recurrent periapical pathology	4 (3.9%)

Table 3: Orthodontic outcome and tooth survival

Outcome	n (%)
Successful planned orthodontic movement	94 (92.2%)
Modification/discontinuation of orthodontic force	8 (7.8%)
Teeth retained at final follow-up	98 (96.1%)
Teeth requiring extraction	4 (3.9%)
Overall tooth survival	96.1%

Table 4: Association of selected variables with treatment outcome

Variable	Statistical finding	p value
Severity of initial trauma	Significant association with unfavourable outcome	0.021*
Pre-existing root resorption	Significant association with progression of resorption	0.014*
Age	No significant association	0.284
Sex	No significant association	0.417
Tooth location	No significant association	0.193

**Statistically significant at p < 0.05.*

Discussion:

This retrospective analysis showed favourable clinical and radiographic outcomes following a combined endodontic-orthodontic approach for traumatized anterior teeth. In this sample, 89.2% of teeth achieved a favourable overall outcome, with successful orthodontic movement in 92.2% of cases and a tooth survival rate of 96.1% at final follow-up. These results indicate that previously traumatized teeth can be successfully incorporated into orthodontic treatment when pulpal and periapical pathology is adequately managed and appropriate biological monitoring is maintained. The prognosis of traumatized teeth is strongly influenced by the type and severity of the original injury and by subsequent pulpal and periodontal healing. Levin *et al.* highlighted the importance of systematic assessment and follow-up in dental trauma, particularly because complications may become evident after the initial injury **[11]**. Similarly, Kohli and Lee reported clinically relevant outcomes following traumatic dental injuries, emphasizing the need for continued observation of affected teeth **[12]**. In the present analysis, severe initial trauma was significantly associated with an unfavourable treatment outcome (p = 0.021), supporting the importance of trauma severity in subsequent treatment

planning. Orthodontic movement of previously traumatized teeth requires particular attention to periodontal and pulpal conditions. Araujo *et al.* emphasized the need for careful interdisciplinary planning when orthodontic treatment is considered in patients with a history of dental trauma **[13]**. In the present study, light and controlled orthodontic forces were employed after satisfactory endodontic management, which may have contributed to the high proportion of teeth successfully moved to their planned orthodontic positions. Root resorption remains one of the principal concerns during orthodontic treatment of traumatized teeth. Previous trauma may alter the periodontal ligament and root surface, potentially increasing susceptibility to resorptive complications. Villaman-Santacruz *et al.* described the complexity of managing traumatized teeth and the importance of long-term clinical and radiographic observation **[14]**. In the present analysis, mild external apical root resorption occurred in 11.8% of teeth, while moderate to severe resorption was observed in 4.9%. Importantly, pre-existing root resorption was significantly associated with subsequent progression of resorption ($p = 0.014$), indicating that baseline root condition should be carefully evaluated before orthodontic forces are initiated. The successful management of traumatized teeth often requires coordination between different dental specialties. Gomes *et al.* emphasized the relevance of interdisciplinary approaches in cases requiring both endodontic and orthodontic intervention **[15]**. Likewise, Carnio *et al.* showed through clinical management of complex traumatized teeth that preservation of compromised anterior teeth may be possible when treatment is appropriately planned and sequenced **[16].** The favourable outcomes observed in the present analysis further support such a coordinated approach. The response of previously avulsed or partially avulsed teeth to orthodontic movement has historically been an important clinical concern. Hines evaluated the radiographic response of previously avulsed and partially avulsed teeth subjected to orthodontic movement, highlighting the need to assess root and periodontal changes during treatment **[17]**. These considerations remain particularly relevant in replanted teeth because damage to the periodontal ligament may predispose them to inflammatory or replacement resorption and ankylosis. External apical root resorption is also influenced by patient related and treatment related variables. Linge and Linge identified several patient characteristics and orthodontic treatment variables associated with apical root resorption **[18]**. Therefore, the occurrence of root resorption should not be attributed exclusively to previous trauma; root morphology, individual susceptibility, treatment duration and characteristics of orthodontic mechanics may also contribute. Regular radiographic assessment is consequently important for early recognition of progressive resorption. Recent epidemiological evidence reported by Tysiąc-Miśta *et al.* further demonstrates the clinical burden and variable presentation of traumatic dental injuries, reinforcing the importance of appropriate diagnosis, documentation and follow-up **[19].** Such structured follow-up becomes particularly important when orthodontic treatment is subsequently planned because delayed complications of trauma may influence both treatment timing and prognosis. Endodontic status should also be considered when planning orthodontic movement. AlMogbel *et al.* discussed the relationship between endodontic treatment and orthodontic procedures and emphasized that endodontically treated teeth can generally undergo orthodontic movement when endodontic treatment is satisfactory and the surrounding tissues are healthy **[20].** In the present study, satisfactory periapical healing was observed in 86.3% of teeth, while only 5.9% required additional endodontic intervention. These findings support the concept that successful endodontic management does not necessarily preclude subsequent orthodontic treatment. Overall, the findings indicate that traumatized anterior teeth should not automatically be excluded from orthodontic treatment. Careful assessment of trauma severity, pulpal and periapical status, root integrity and periodontal healing is essential before initiating tooth movement. Adequate endodontic treatment, appropriate timing of orthodontic intervention, application of light controlled forces and periodic clinical and radiographic monitoring appear to be key factors for favourable outcomes. Particular caution is warranted in teeth with severe initial trauma, pre-existing root resorption, avulsion, or evidence of ankylosis. This study has limitations inherent to its retrospective design, including reliance on the completeness of clinical records and radiographs, variation in the nature and severity of traumatic injuries and potential differences in treatment protocols and follow-up periods. Additionally, the limited sample size may restrict the generalizability of the findings. Prospective multicentre studies with standardized endodontic and orthodontic protocols, extended follow-up periods and uniform radiographic assessment are needed to further clarify the long-term prognosis of traumatized anterior teeth undergoing combined endodontic orthodontic treatment.

Conclusion:

A combined endodontic-orthodontic approach provides favourable outcomes for the preservation and successful movement of traumatized anterior teeth. Appropriate endodontic management, controlled orthodontic forces and regular clinical and radiographic monitoring are essential for minimizing complications such as root resorption. Careful case selection and interdisciplinary treatment planning are crucial for achieving predictable long-term outcomes.

References:

[1] Bourguignon C *et al. Dent Traumatol*. 2020 **36**:314. [PMID: 32475015]
[2] Zhang N *et al. Pak J Med Sci*. 2026 **42**:258. [PMID: 41737173]
[3] Weissheimer T *et al. Int Endod J.* 2021 **54**:1246. [PMID: 33780015]
[4] Zogakis IP *et al. Dent J (Basel).* 2026 **14**:288. [PMID: 42187666]
[5] DE Rosa A *et al. Minerva Dent Oral Sci.* 2026 **75**:214. [PMID: 41773286]
[6] Alhadainy HA *et al. J Endod*. 2019 **45**:483. [PMID: 30904319]

[7] Bakkari & Salamah FB. *Cureus*. 2022 14:e28943. [PMID: 36237800]
[8] Yoshpe M *et al. Angle Orthod*. 2025 **95**:173. [PMID: 39805315]
[9] Bayir F & Gumus EB. *J Dent Res Dent Clin Dent Prospects.* 2021 **15**:100. [PMID: 34386180]
[10] Fouad AF *et al. Dent Traumatol.* 2020 **36**:331. [PMID: 32460393]
[11] Levin L *et al. Dent Traumatol*. 2020 **36**:309. [PMID: 32472740]
[12] Kohli MR & Lee SM. *Dent Clin North Am*. 2026 **70**:609. [PMID: 42276604]
[13] Araujo ACDS *et al. Brazilian Journal of Implantology and Health Sciences.* 2024 **6**:676. [DOI: 10.36557/2674-8169.2024v6n2p676-690]
[14] Villaman-Santacruz H *et al. Dent Med Probl*. 2022 **59**:437. [PMID: 36206494]
[15] Gomes BPFA *et al. Clin Oral Investig*. 2023 **27**:4757. [PMID: 37401984]
[16] Carnio J *et al. Clin Adv Periodontics*. 2026 **16**:646. [PMID: 41761936]
[17] Hines FB Jr. *et al. Am J Orthod.* 1979 **75**:1. [PMID: 283691]
[18] Linge L & Linge BO. *Am J Orthod Dentofacial Orthop*. 1991 **99**:35. [PMID: 1986524]
[19] Tysiąc-Miśta M *et al. Arch Acad Emerg Med*. 2024 **13**:e11. [PMID: 39465059]
[20] AlMogbel AA *et al. Cureus*. 2024 **16**:e56821. [PMID: 38654793]

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.