

Diagnostic Significance of Frenal Attachment Injuries in Abuse: Insights from Forensic Nursing and Forensic Odontology

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ABSTRACT

Frenal attachment injuries, particularly tears of the labial or lingual frenulum, are often considered potential indicators of non-accidental injury, especially in paediatric and other vulnerable populations. However, their diagnostic significance remains complex and requires careful interpretation within a broader clinical and forensic context. This paper aims to evaluate the role of frenal injuries as indicators of abuse through an interdisciplinary lens integrating forensic nursing and forensic odontology. The study reviews the anatomical variations of frenal attachments, their prevalence across populations, and their clinical implications. It further examines the mechanisms underlying frenal injuries, distinguishing between accidental and non-accidental causes, and highlights the importance of correlating injury patterns with developmental status, clinical history, and associated trauma. Evidence from existing literature underscores that frenal tears are not pathognomonic of abuse and may occur in both accidental and abusive settings.

Keywords: Frenal Injuries, Forensic Nursing, Forensic Odontology, child abuse, oral trauma

Int J Eth Trauma Victimology (2026). DOI: 10.18099/ijetv.v12i01.05

INTRODUCTION

Abuse is a common phenomenon today, and medical professionals are often the first to identify signs of it. Considering the responsibilities of forensic personnel, particularly forensic medical professionals, detecting and addressing child abuse and other forms of abuse is a critical priority. Nurses often serve as essential frontline professionals in identifying and evaluating injuries resulting from abuse, and their role extends beyond clinical care to include comprehensive documentation, evidence collection, and collaboration with legal entities.¹

Frenal injuries, particularly tears or lacerations of the labial or lingual frenulum, constitute significant clinical signs suggestive of non-accidental trauma, especially in paediatric populations and vulnerable adults. The presence of frenal tears, especially when inconsistent with the given history or occurring alongside other suspicious injuries, should alert dental practitioners to possible non-accidental trauma. Dentists and forensic odontologists possess critical clinical expertise in the oral cavity and play a dual role: managing traumatic oral injuries clinically while providing medico-legal documentation vital for abuse investigation.²

Forensic odontology's broader role encompasses human identification, bite mark analysis, and interpreting oral trauma; however, in relation to frenal injuries specifically, the field provides essential insight into the injury timing, causality,

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How to cite this article: Bhalerao SM, Mathew A. Diagnostic Significance of Frenal Attachment Injuries in Abuse: Insights from Forensic Nursing and Forensic Odontology. *Int J Eth Trauma Victimology*. 2025;12(1):31-34.

Source of support: Nil

Conflict of interest: None

Received: 20/05/2026;

Received in revised form: 20/06/2026;

Accepted: 25/06/2026;

Published: 28/07/2026;

and pattern recognition.² Radiographic evaluations and dental record comparisons supplement clinical findings, enabling precise age estimation of injuries and facilitating correlation with the alleged abuse event.³

Moreover, clear and precise clinical injury documentation is paramount, as inconsistent or vague terminology harms the forensic utility of medical reports, potentially impeding injury mechanism reconstruction and legal decision-making.⁴ Despite the clinical significance of frenal injuries, several challenges persist, including ambiguous clinical terminology and inconsistent documentation practices, and such ambiguities can obstruct the forensic interpretation necessary for legal proceedings. In the context of this paper, these injuries will be examined from a forensic perspective.

METHODOLOGY

This narrative literature review evaluated the diagnostic significance of frenal attachment injuries in suspected abuse from the perspectives of forensic nursing and forensic odontology. A structured search of PubMed, Scopus, Google Scholar, Web of Science, and ScienceDirect was conducted using keywords including *frenal tear*, *labial frenulum injury*, *lingual frenulum injury*, *child abuse*, *non-accidental injury*, *forensic odontology*, *forensic nursing*, and *oral trauma*. Relevant case reports, observational studies, systematic and narrative reviews, and clinical guidelines published up to 2025 were included, while articles lacking forensic relevance were excluded. The selected literature was critically analysed and synthesised to provide an evidence-based overview of the forensic significance of frenal attachment injuries.

Types of Frenal Attachment Based on Attachment Site

The labial frenum, which connects the lip to the alveolar mucosa and underlying periosteum, exhibits variations in its attachment pattern. These variations are primarily classified based on the level at which the frenal fibres attach in relation to the gingiva and alveolar mucosa. Systems such as those proposed by Placek and Sewerin are commonly used to categorise these attachment types. (Table 1)

The maxillary labial frenum is commonly classified according to its insertion into four types

- *Mucosal attachment*

Attached at the mucogingival junction; most common and least clinically significant.

- *Gingival attachment*

Fibres insert into attached gingiva and may contribute to gingival recession.

- *Papillary attachment*

Extends into the interdental papilla and may be associated with midline diastema.

- *Papillary penetrating attachment*

Extends through the papilla toward the palatal aspect; least common.

Frenal Tears and Abuse: Clinical and Forensic Perspectives

Frenal tear injuries, particularly in children, have long been regarded as possible indicators of non-accidental injury (NAI) or physical abuse. Studies on paediatric facial trauma have shown that frenal tears are also seen in ambulatory children and often occur alongside other facial injuries resulting from accidental causes.⁵ This highlights the importance of considering the child's mobility, developmental stage, and the plausibility of the reported history when evaluating such findings.

Injury Mechanism in Abuse-Related Frenal Tears

In cases where abuse is confirmed, frenal tears are more likely to result from deliberate trauma involving excessive stretching or tearing of the frenum. This may occur due to forceful pulling of the lip or mouth, direct blunt force to the oral region, or repeated minor trauma inflicted over time. These injuries are rarely isolated. They are often accompanied by additional findings such as soft tissue injuries, including lacerations and contusions, as well as more serious conditions like fractures or intracranial injuries, which raise suspicion of non-accidental trauma.^{6,7} In some instances, frenulum injuries have been reported alongside severe manifestations such as retinal haemorrhages or subdural hematomas, indicating the application of significant force.⁸ Such injuries may arise from everyday incidents, including falls in ambulatory children, accidental impacts to the face, or even medical interventions. Children who can walk and explore their environment are particularly prone to sustaining minor oral injuries, including frenal tears, during routine activities.⁵

Importance of Clinical Context and Comprehensive Evaluation

Regarding frenal injuries specifically, H. Carty (1988) identifies torn frenulum as a clinical finding that “must raise the question” of NAI diagnosis, yet emphasises distinguishing this from accidental injury through comprehensive clinical assessment.^{9 10}

Martina Focardi *et al.* (2024) demonstrate that 1.43% of suspected abuse cases (6/418) were actually “Mimics”, alternative etiologies including medical conditions and alternative medicine practices, requiring multidisciplinary team evaluation to prevent diagnostic errors.¹¹

Table 1: Summary of frenal attachment types and their prevalence

Frenal attachment type	Description	Approximate prevalence
Mucosal	Attached at the mucogingival junction	18–74%, varies by population
Gingival	Attached to the attached gingiva closer to the gingival margin	36–65%
Papillary	Inserted into the interdental papilla	8–15%
Papillary penetrating	Extends through the interdental papilla	2–6%



Medico-Legal Framework in the Assessment of Abuse

Medico-legal professionals are required to prepare clear, objective, and thoroughly documented reports that meet the standards expected in a court of law. Inadequate or poorly maintained documentation can significantly reduce the evidentiary value of clinical findings.¹² In addition, when serving as expert witnesses, medical professionals must adhere to the highest ethical standards and possess a sound understanding of courtroom procedures.¹³ The use of a structured medico-legal reporting framework, with clearly defined format and standards, helps ensure objectivity in report writing. It also serves as a valuable tool for training, facilitates peer review and audit processes, and supports the formulation of well-founded professional opinions.¹⁴

Forensic nursing protocols establish standardised procedures for examining abuse victims, collecting evidence, and maintaining legal integrity.¹⁵ Key components include proper documentation, photography, and chain of custody maintenance.¹⁶ For intra-oral injuries, comprehensive examination of lips, gums, tongue, and palate is essential.¹⁷

Joint Forensic Perspectives in Identifying Abuse Through Frenal Injuries

Collecting a thorough history of the injury is crucial. This should include details such as the patient's developmental stage, level of mobility, particularly in children, the reported mechanism of trauma, and the timing of the event. Such contextual information plays an important role in distinguishing between accidental and non-accidental causes of frenal injuries and helps guide further evaluation and management.¹⁸

For clinical training, Objective Structured Clinical Examinations (OSCEs) are assessment tools for nursing students; their methodology reflects real-world clinical skill acquisition and evaluation, emphasising objective, hands-on examination skills that nurses employ when assessing oral trauma such as frenal injuries. OSCEs train nurses to perform systematic, standardised, and objective assessments, which are crucial for reliable diagnosis.¹⁹

Collaborative assessments bring together clinicians with complementary skills, allowing a more holistic evaluation of frenal injuries. For example, nurses often perform initial patient assessments and gather detailed histories, dentists contribute specialised oral examination skills and trauma recognition, and physicians may evaluate systemic or related injuries. This multidisciplinary input leads to a more accurate diagnosis by correlating clinical findings with patient history, developmental status, and injury context, which is particularly important in differentiating accidental from non-accidental trauma.²⁰

Effective communication within the team ensures critical information about injury mechanisms, physical findings, and patient background is mutually understood. Collaborative environments employing shared electronic health records or clinical decision support systems (CDSS) help reduce information gaps and improve the completeness and accuracy

of the injury history and examination findings. Such systems facilitate interdisciplinary collaboration and support timely diagnosis and intervention plans.²¹

DISCUSSION

A major challenge in forensic practice is the absence of standardised diagnostic criteria for evaluating frenal injuries. Variations in clinical terminology, examination methods, and reporting practices can affect both forensic interpretation and legal outcomes.

Kidd *et al.* reported that frenal injuries alone are insufficient to diagnose abuse and should always be interpreted within the broader clinical context. Similarly, Reading's systematic review concluded that intraoral injuries should prompt careful evaluation but cannot independently confirm abuse.⁵ Recent work by Shah *et al.* further emphasises that oral injuries should be assessed alongside developmental stage, injury mechanism, caregiver history, and associated physical findings such as bruising, fractures, retinal haemorrhage, or intracranial injury.⁸ The case series by Focardi *et al.* also demonstrated that several conditions initially suspected to represent abuse were later identified as mimics, highlighting the importance of multidisciplinary assessment and avoiding diagnostic bias.¹¹

Advances in forensic odontology, including high-resolution intraoral photography, three-dimensional imaging, and digital documentation, offer promising opportunities to enhance the objective assessment of oral injuries. Although these technologies are increasingly available, their application in abuse investigations remains limited and requires further validation through clinical research.²¹

The current literature is largely based on case reports and retrospective studies, highlighting the need for prospective multicentre research involving larger and more diverse populations. Future studies should focus on correlating injury characteristics with developmental stage, mechanism of injury, associated clinical findings, and medico-legal outcomes to establish stronger diagnostic evidence.

CONCLUSION

Frenal attachment injuries represent important findings in the assessment of suspected abuse but should never be interpreted in isolation. Current evidence demonstrates that such injuries are not pathognomonic of abuse and require careful correlation with developmental status, clinical history, associated injuries, and multidisciplinary evaluation. Standardised reporting methods, continued professional training, and interdisciplinary collaboration remain essential for improving diagnostic accuracy and ensuring appropriate legal outcomes.

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