

# Effective of clinical and radiological variables in diagnoses of intrusion in permanent teeth

Karam Ammar Ammoun<sup>1\*</sup>, Samira Zraiki<sup>2</sup>

<sup>1</sup>MSD Oral Medicine Department, Faculty of Dentistry, Lattakia University, Lattakia Syria

<sup>2</sup>Phd in oral Medicine, Faculty of Dentistry, Lattakia University, Lattakia Syria

## Abstract

Dental intrusion is considered one of the most severe forms of traumatic dental injuries due to its extensive damage to the dental pulp, periodontal ligament, and alveolar bone, making accurate diagnosis essential for proper management and prognosis. This study aimed to identify the main clinical and radiographic signs associated with traumatic dental intrusion in permanent teeth and to evaluate the degree of correlation between these variables and the final diagnosis of dental intrusion, with particular emphasis on the influence of root development status. A clinical study was conducted on 54 patients (41 males and 13 females) aged between 5 and 22 years, who presented with a total of 79 intruded teeth. All cases were emergency presentations. Each patient underwent a comprehensive clinical and radiographic examination. The assessed variables included incisal edge level discrepancy, gingival sulcus bleeding, percussion sound, percussion sensitivity, tooth mobility, and radiographic changes in the periodontal ligament space. The final diagnosis of dental intrusion was established based on the combined assessment of these parameters. Statistical analysis was performed to evaluate the association between individual clinical and radiographic findings and the final diagnosis. The findings demonstrated an inconsistent and weak correlation between individual clinical and radiographic variables and the final diagnosis of dental intrusion. While gingival sulcus bleeding was observed in all cases, other commonly used diagnostic indicators—such as metallic percussion sound, percussion sensitivity, tooth mobility, and radiographic obliteration of the periodontal ligament space—showed variable presence and limited diagnostic reliability. Similar trends were observed in teeth with incomplete root formation, with no strong association identified between single diagnostic variables and confirmed intrusion. Clinical and radiographic signs traditionally used in the diagnosis of dental intrusion should be considered supportive rather than definitive diagnostic tools. Reliance on a single clinical or radiographic finding may lead to diagnostic errors. A combined assessment of three or more clinical and/or radiographic parameters is recommended to achieve an accurate diagnosis of traumatic dental intrusion.

**Keywords:** Clinical variables, Radiological variables, Permanent teeth, Dental intrusion, Traumatic dental injuries, Clinical diagnosis, Intrusive luxation.

## Introduction

Dental intrusion (intrusive luxation) is a traumatic injury affecting a single tooth or a group of teeth, resulting in displacement of the tooth into the surrounding tissues and causing axial crushing damage that leads to extensive injuries involving the dental pulp, periodontal ligaments, alveolar bone, and cementum [1]. Consequently, this type of dental trauma is considered one of the most severe injuries with the poorest prognosis [2].

The initial diagnosis of dental intrusion in permanent teeth is based on the discrepancy in the level of the incisal edge of the affected tooth or teeth compared with adjacent unaffected teeth, in addition to bleeding from the gingival sulcus [3]. In the mixed dentition, however, diagnosis is more challenging, as the intruded tooth may mimic a tooth in the eruptive phase. Furthermore, the intruded tooth may be completely absent from the dental arch, leading to a potential misdiagnosis as complete avulsion [4].

Percussion testing helps determine whether the tooth is erupting, producing a dull sound, or ankylosed and embedded within the alveolar bone, producing a metallic sound [5].

Dental intrusion may be partial, with a portion of the crown remaining clinically visible, or complete [6], where the entire tooth is displaced into the alveolar socket and, in some cases, into the nasal cavity [7].

Clinical palpation may allow detection of the root apex of the intruded tooth [8,15].

Radiographically, dental intrusion can be identified by narrowing or obliteration of the periodontal ligament space, in addition to fractures at the apex of the alveolar process [9].

## Aim of the study

This study is considered one of the unique investigations aimed at identifying the main clinical and radiographic signs and symptoms characteristic

of dental intrusion in permanent teeth, as well as evaluating the effectiveness and correlation of each parameter in establishing the final diagnosis. This approach facilitates accurate diagnosis and helps avoid potential diagnostic errors. Additionally, the study aims to assess the impact of the stage of permanent tooth development (root completion) on clinical variables and, consequently, on the diagnosis of dental intrusion.

## Materials and Methods

This study was conducted on 54 patients (41 males and 13 females) who attended the National Hospital in the city of Latakia. The study period extended over two years (2023–2024). The final diagnosis was established based on the presence of the following clinical and radiographic findings:

1. Discrepancy in the incisal edge level of affected teeth compared to adjacent unaffected teeth.
2. Bleeding from the gingival sulcus.
3. Metallic sound on percussion.
4. Percussion sensitivity.
5. Tooth mobility.
6. Radiographic obliteration of the periodontal ligament space.

All cases included in the study were emergency cases, and the patients' ages ranged from 5 to 22 years. A total of 12 teeth with incomplete root formation were included. Each patient underwent a detailed history-taking process, followed by clinical and radiographic examinations, after which appropriate treatment was performed according to the final diagnosis. The correlation between clinical and radiographic findings and the final diagnosis was subsequently analyzed.

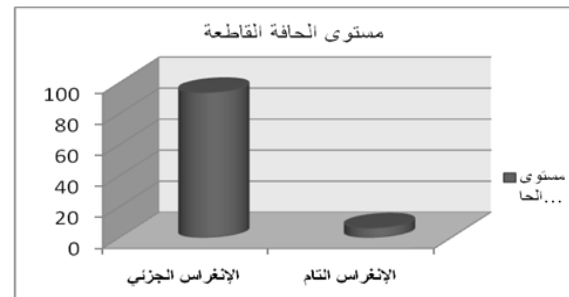
## Results

Based on the clinical and radiographic examinations of each patient and the analysis of the assessed variables, the following results were obtained:

**1. Discrepancy in the incisal edge level of affected teeth compared with adjacent unaffected teeth:** It was observed that only 6.3% of the intruded teeth in the studied sample (5 out of 79 teeth) were

completely intruded. All of these teeth were maxillary central incisors in patients aged 5–6 years.

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**Fig (1):** Discrepancy in the incisal edge level of affected teeth compared with adjacent unaffected teeth

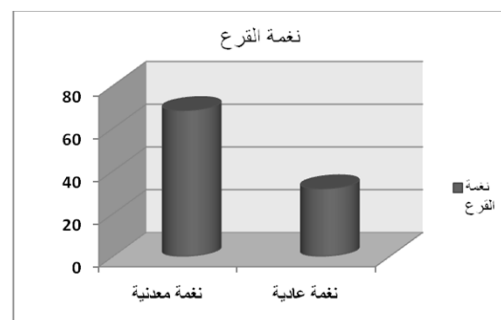
## 2. Bleeding from the gingival sulcus

Since all cases included in the study were recently traumatized teeth (emergency cases), bleeding from the gingival sulcus was present in 100% of the studied cases.

## 3. Metallic sound on percussion

A lack of association between the metallic percussion sound and the final diagnosis of traumatic dental intrusion was observed in 31.7% of cases (25 out of 79 teeth). Conversely, a metallic percussion sound was detected in 68.2% of the cases.

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**Fig (2):** Metallic sound on percussion

#### 4. Percussion sensitivity

The study demonstrated an incomplete correlation between percussion sensitivity and the final diagnosis of dental intrusion. A negative percussion response was observed in 26.6% of cases (21 teeth), whereas a positive response was recorded in 73.4% of cases (58 teeth).

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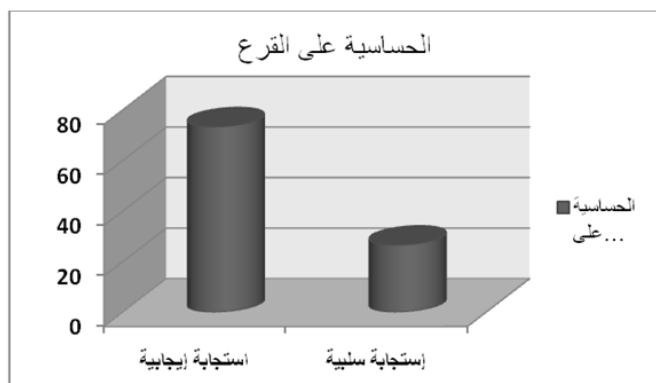


Fig (3): Percussion sensitivity

#### 5. Tooth mobility

The majority of teeth diagnosed with dental intrusion (84.8%, 67 teeth) were clinically stable and did not exhibit any detectable mobility. However, 15.2% of the teeth demonstrated mobility, ranging from Grade I mobility (8 teeth) to Grade II mobility (4 teeth).

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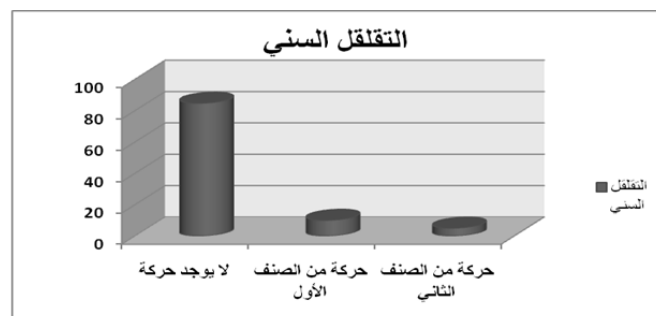


Fig (4): Tooth mobility

#### 6. Radiographic obliteration of the periodontal ligament space

The correlation between radiographic findings and the final diagnosis of dental intrusion was weak. Radiographic obliteration of the periodontal ligament space was observed in only 21.1% of cases (17 teeth). Narrowing of the periodontal ligament space was noted in 37.9% of cases (30 teeth), while in 40.5% of cases (32 teeth), the periodontal ligament space maintained its normal width.

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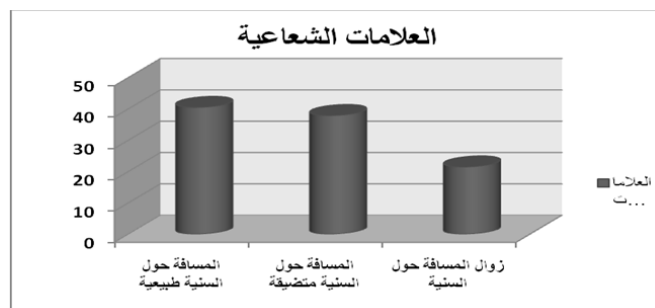


Fig (5): Radiographic obliteration of the periodontal ligament space

#### Findings in teeth with incomplete root formation

In teeth with incomplete root development, complete dental intrusion was observed in 5 cases (41.6%), whereas partial intrusion was detected in 7 cases (58.4%).

Bleeding from the gingival sulcus was present in 100% of cases.

Regarding percussion sound, 6 cases (50%) exhibited a normal percussion tone, while a metallic tone was detected in the remaining 6 cases (50%).

Percussion sensitivity was positive in 7 cases (58.3%) and negative in 5 cases (41.6%).

Tooth mobility of Grade I was observed in 4 cases (33.3%), and Grade II mobility in 1 case (8.3%), whereas the remaining cases (58.3%) were clinically stable.

Radiographically, obliteration of the periodontal ligament space was observed in 7 cases (58.3%), while narrowing was noted in 5 cases (41.6%). No cases demonstrated a radiographically normal periodontal ligament space in teeth with incomplete root formation.

## Discussion

Dental intrusion is considered a severe traumatic injury due to the inevitable damage it causes to the dental pulp as a result of compromised pulpal blood supply. Additionally, intrusion commonly affects the alveolar process, which is frequently associated with fractures, [10]. and results in unavoidable injury to the periodontal ligament through ligament rupture and bacterial contamination of the area following tooth displacement [11].

Several studies have indicated that the degree of pulpal development and the type of endodontic treatment performed in teeth affected by dental intrusion may influence the clinical variables used for diagnosing dental intrusion [12]. In the present study, a lack of complete correlation between clinical and radiographic findings and the diagnosis of dental intrusion was observed across the entire study sample, including teeth with incomplete root development, with only minor (non-significant) differences in the degree of association between these variables and dental intrusion. However, further investigation is required due to the limited sample size [13].

Therefore, the known clinical and radiographic signs used in the diagnosis of dental intrusion should be considered supportive but not definitive diagnostic tools. It is recommended to rely on three or more clinical and/or radiographic parameters to confirm a diagnosis of dental intrusion. This recommendation is consistent with the findings reported by Andreasen and other related studies [14].

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