# The diagnostic value of lateral extraoral radiography for intruded maxillary primary incisors

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## Abstract

**Purpose**: The purpose of the study was to assess the contribution of a lateral extraoral radiograph for diagnosing the relation between the root of intruded maxillary primary incisors and their permanent successors.

**Methods**: Three pediatric dentists examined intruded primary teeth 0-7 days after injury. The relations between the primary and permanent teeth were assessed in three separate steps: 1) evaluation of clinical signs only; 2) evaluation of a periapical radiograph (no lateral radiograph); 3) evaluation of a lateral extraoral radiograph. The clinical and radiographic signs used to assess the relations were recorded. The lateral extraoral radiograph was regarded as contributory to diagnosis if the assessment after the third step differed significantly from that made after the first and second steps. Ninety-three evaluations of 53 intruded teeth in 37 children were available for analysis.

**Results**: The lateral extraoral radiograph was found valuable for assessment of the primary incisor's root alignment in only 5% (5/93) of the evaluations in which neither the clinical examination nor the periapical radiograph were contributory. Four of these five cases were in children less than 20 months old. In all other cases, the lateral radiograph was not contributory for two main reasons: It could not be evaluated due to overlap of multiple intruded teeth and/or when the teeth intruded were lateral incisors, and when the clinical and periapical radiographs were sufficient for diagnosis.

**Conclusions**: Lateral extraoral radiographs should not be used routinely in cases of intrusion of primary incisors. The operator should base his or her diagnosis on clinical findings and examination of a periapical radiograph. The lateral extraoral radiograph should be taken only when its expected contribution to diagnosis can be confirmed, as in cases of children younger than 20 months.*(Pediatr Dent 24:38-42, 2002)*

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Intrusive luxation has been defined as "displacement of the tooth deeper into the alveolar bone."[1] Some authors found intrusion to be the most common type of injury to the primary incisor region,[2,3] while others reported intrusion to comprise 8.4% to 21.6% of all luxation injuries of primary anterior teeth.[4-6] The close proximity of the root of the primary incisor to the labial surface of its permanent successor increases the risk of damage to the developing bud when the primary incisor is injured.[7] The root of the primary tooth was found to be pushed palatally toward the permanent tooth bud in less than one fifth of the cases.[8]

However, in these cases, the injury may inflict severe damage to the succedaneous tooth,[9] and immediate extraction of the primary incisor is advocated.[1,10] It is, therefore, important to determine the relation between the root of the intruded primary incisor and its permanent successor shortly after the injury. A lateral extraoral radiograph has been suggested as an aid in diagnosing the relation between the primary and permanent teeth.[1,10,11]

The aim of the present study was to assess the contribution of a lateral extraoral radiograph in determining the location of the roots of intruded maxillary primary incisors, and their relations to the permanent successors.

## Methods

The study group consisted of all children with intruded primary incisors who presented to the emergency clinic of the Department of Pediatric Dentistry at the Hadassah School

**Table 1. Ability to Assess the Primary Root Alignment with (Step 1+2+3) and without (Step 1+2) the Examination of the Lateral Extraoral Radiograph: All Evaluations**

| | Without lateral extraoral radiograph (steps 1+2*) | | |
|---|---|---|---|
| | Able to assess | Unable to assess | Total |
| With lateral extraoral radiograph (steps 1+2+3*) | | | |
| Able to assess | 83 | 5 | 88 |
| Unable to assess | 0 | 5 | 5 |
| Total | 83 | 10 | 93 |

*Step 1: clinical examination only; Step 2: examination of periapical radiograph; Step 3: examination of lateral extraoral radiograph. McNemar $P$=0.063.

of Dental Medicine in Jerusalem, Israel, during a period of 18 months. The children were examined, and the relation between the root of intruded maxillary primary incisors and their permanent successors was assessed. Teeth intruded more than seven days prior to the initial examination were not included in the study.

A periapical radiograph of the intruded teeth and a lateral extraoral radiograph were taken. Each of the injured teeth was independently examined by one to three experienced pediatric dentists. They assessed the relation between the root of each intruded tooth and the crown of its permanent successor, based on a three-step examination as follows:

**Step 1**: Clinical examination only (ie, inspection of the tooth, the surrounding soft tissues and examination of the labial bone plate by digital palpation of the vestibule (or over the upper lip, when swelling did not allow intraoral examination). In cases of partial intrusion, the alignment of the intruded tooth could be compared to that of adjacent non-affected teeth.

**Step 2**: Evaluation of a periapical radiograph (ie, the image of the intruded primary teeth compared to that of adjacent non-intruded teeth and on the alignment of the permanent teeth in its follicle). In some occasions, the clinical examination (Step 1) was repeated.

**Step 3**: Evaluation of the lateral extraoral radiograph (ie, the location of the apex of the intruded incisor, its proximity to the labial aspect of the permanent tooth and fracture of the labial bone plate if present). Evaluators were allowed to repeat Steps 1 and 2.

The assessments of the relations between the root of the intruded primary incisors and the developing bud of their permanent successors were recorded after each step and prior to proceeding to the next step. "Unable to assess" (insufficient data or low quality radiographs) was an acceptable answer. The evaluators were asked to base their assessment on clinical or radiographic signs such as: direction of the crown (if visible); presence or absence of a hematoma in the vestibule and upper lip; projection of the labial bone plate; relatively shortened or elongated image of the injured tooth on the periapical radiograph and its radio-density). When the evaluator could not determine the root alignment and stated "Unable to assess," he or she was asked to specify the reason for the inability to assess.

The evaluations of each examiner were made independently, with no attempt to reach a consensus among evaluators.

The lateral extraoral radiograph was regarded as contributory if a final decision could not be made without the 'Step 3' or if it differed from that made following the first and second steps. In all other cases it was considered as non-contributory

### Study population

Thirty-seven children (23 boys and 14 girls) with 55 intruded primary incisors were included in the study. Their age ranged between 8 and 63 months with a mean of 26.4 months and median 21 months. Fifty six percent (31 teeth) were partially intruded and 44% (24 teeth) completely disappeared in the tissues. Twenty-nine children (with 44 teeth) were checked within the first two days after the injury. Sixty percent (21 children) had only one intruded primary incisor and the others had 2 or more injured teeth.

Two intruded lateral primary incisors were excluded from the study due to congenitally missing permanent successors. A total of 93 three-step evaluations were available for statistical analysis: Fifteen intruded teeth were evaluated by a single examiner (=15 evaluations). Thirty-six teeth were evaluated by two examiners (=72 evaluations) and two teeth were evaluated by three examiners (=6 evaluations).

The evaluators' ability to assess the tooth alignment following step 2 and step 3 was statistically analyzed using the McNemar test.

## Results

Assessment of the alignment of the intruded primary incisor was possible in 86% (80/93) of the evaluations of step 1, 62% (58/93) of step 2 and 42% (39/93) of step 3. In all other evaluations the evaluators were "unable to assess." In 29 evaluations (31%), all three steps presented sufficient information for assessment of the tooth alignment. In 26 evaluations (28%), the results of steps 1 and 2 were useful with no contribution of step 3. In another 21 evaluations (23%), only step 1 was contributory. In 5 evaluations (5%), step 3 was the only contributory examination.

The difference between the evaluators' ability to assess the tooth alignment after steps 2 and 3 was not significant (Table 1).

In an attempt to identify specific conditions in which the lateral extraoral radiograph may be contributory, statistical analysis was made separately for evaluations of:

1. Intrusion of a *single* tooth.
2. Intrusion of *multiple* teeth in the same patient.
3. Intrusion of *central* incisors.
4. Intrusion of *lateral* incisors.
5. *Partially* intruded teeth.
6. Teeth that *completely disappeared* in the tissue.
7. Teeth intruded in children *less than 20 months old.*
8. Teeth intruded in children *20 months and older.*

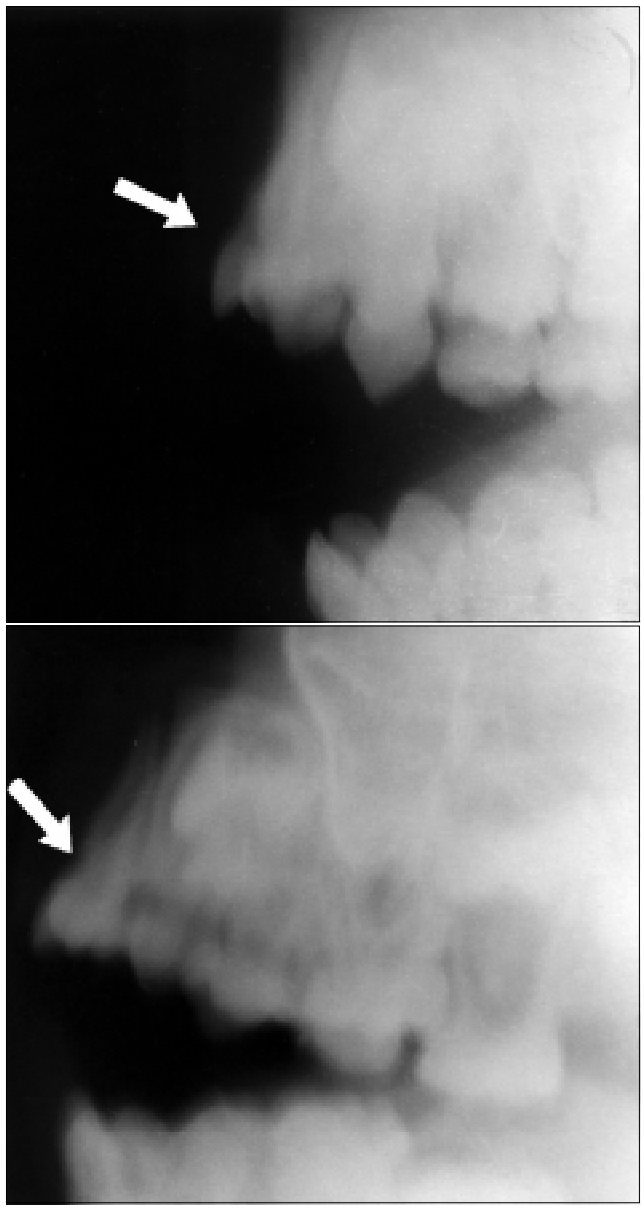
Fig 1. Diagnostic periapical radiograph of the maxillary incisors showing rotated alignment of the left permanent incisors without any history or signs of trauma

No significant difference ($P>0.5$) was found in all these cases between the ability of the evaluators to assess the tooth alignment after steps 1 and 2 and following all three steps.

The patients' age in 4 of 5 of these cases was 18-19 months. In another 5 evaluations (5%), no steps were contributory to the determination of the tooth alignment. In all 5 cases, the patients' age was 18-19 months at time of injury.

When multiple intruded incisors were involved, the lateral extraoral radiograph could assess the alignment of 26% (14/53) of the teeth compared to 62% (25/40) when a single primary incisor was intruded. The lateral extraoral radiograph could assess 46% (38/83) of intruded central incisors compared to 10% (1/10) of lateral incisors.

When teeth were evaluated by more than one evaluator, there was agreement between evaluators in all but six steps. One case of disagreement was in evaluation of step 2 and five other cases of disagreement were in step 3. In all six cases, one of the evaluators assessed "labial displacement" while the other evaluator was "unable to assess."



Figs 2a and 2b. Two lateral extraoral radiographs of the same patient both taken shortly after intrusion of the maxillary right primary central incisor. The alignment of the root of the intruded tooth cannot be seen on one radiograph (2a) but can be clearly seen to be pushed labially on the other (2b) due to a slight shift of the central x-ray beam.

## Discussion

The findings of this study clearly show that in cases of intrusion of maxillary primary incisors, the contribution of the lateral extraoral radiograph in determining the alignment of the root of the intruded teeth is low. As the majority of intruded incisors are pushed labially, as described by Holan and Ram,[8] one would expect it to be reflected in the evaluation of the lateral extraoral radiograph. However, in the present study, the lateral extraoral radiographs showed labial alignment of the root in only 42% of the evaluations. This is explained by the limitations of the lateral extraoral radiograph when pertaining to lateral incisors and in cases of multiple intrusions.

Overlap of structures on the lateral extraoral radiograph does not allow the evaluator to assess the relations between the root of the intruded primary incisor and the crown of its permanent successor. This becomes more difficult when two or more incisors are intruded. When a lateral extraoral radiograph is taken, the cone is directed perpendicular to the midsagital plane of the head; the central x-ray beam is tangent to the labial surface of the permanent incisor crown and shows its relation to the root of the intruded primary tooth.

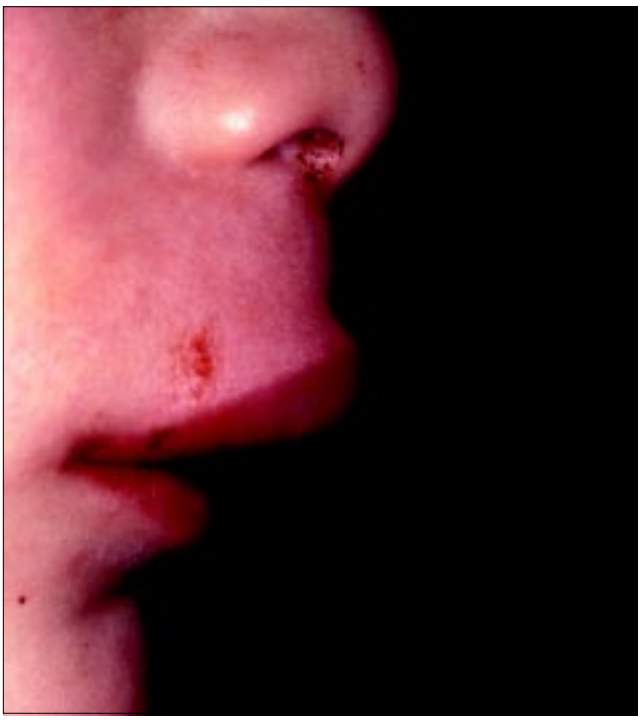


Fig 3. A lateral view of a child following intrusion of both maxillary primary central incisors. Notice the projection of the upper lip due to hemorrhage and edema, suggesting a labial shift of the apices of the intruded teeth.

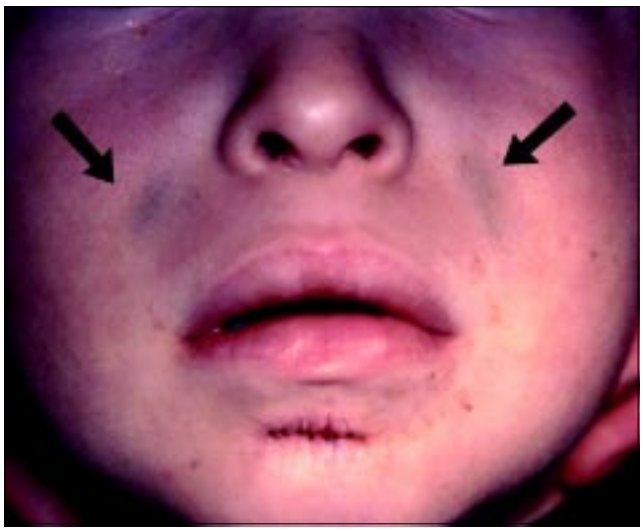


Fig 4. A front view of a child following intrusion of both maxillary primary central incisors. Notice the swelling of the upper lip and the subcutaneous hemorrhage on both sides of the nose (arrows), suggesting a labial and distal shift of the apices of the intruded teeth.

Fig 5. Clinical view of the upper lip and maxillary teeth of a two years old boy shortly after intrusion of the maxillary left central and lateral primary incisors. Notice the hemorrhage in the vestibule and lip, suggesting a labial shift of the apices.

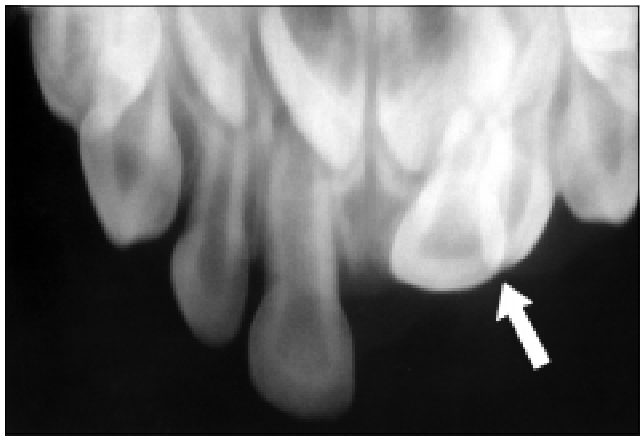


Fig 6. A periapical radiograph of the maxillary incisors of the patient in Fig 4. Notice the shortened and more opaque image of the left central and lateral primary incisors (arrow) indicating a labial shift of the apices. The crowns of the right permanent incisors are in a rotated position (arrow).

This, however, has no value when the permanent incisors were initially in a rotated position without any history a previous trauma that might have changed their alignment (Fig 1). A minimal shift in the direction of the cone or a slight rotation of the child's head during exposure will result in failure of the radiograph to provide the required image (Figs 2a and 2b).

Based on the lateral extraoral radiograph alone, one can determine the actual relations between the teeth only when it clearly shows that the root of the intruded primary incisor has been pushed labially, accompanied by fracture of the labial bone plate. However, in these cases the clinical signs and a periapical radiograph are sufficient to make a definite diagnosis. Conversely, if the lateral extraoral radiograph does not show a labial position of the root, one cannot conclude that the root has necessarily been pushed toward the permanent tooth.

Swelling of the upper lip (Fig 3), subcutaneous hematoma adjacent to the nostrils (Fig 4) and in the maxillary anterior vestibule (Fig 5) and projected labial bone plate confirmed by palpation are clinical findings indicating that the root of an intruded primary incisor is displaced labially. The absence of such signs should alert the operator to suspect palatal displacement of the primary tooth root.

Despite the high contribution of the clinical examination (86%) found in this study, confirmation of diagnosis must be based on radiographic findings. While the lateral extraoral radiograph was found to have only limited value, the periapical radiograph provides important clues to help diagnosis.

Some radiographic findings contribute to diagnose labial displacement of the root. To illustrate this point, one can mention a gap between the apex of the primary incisor and the crown of its permanent successor; a shortened, more opaque image of an intruded incisor as compared to an adjacent non-displaced tooth (Fig 6) and lack of rotation of the permanent successor.

The value of the lateral extraoral radiograph seems to be limited to cases of intrusion of a single central incisor when no projection of the labial bone plate can be detected and a periapical radiograph shows proper alignment of the permanent successor.

When the patient is younger than 20 months at the time of injury, it is sometimes difficult to assess the alignment of the primary incisor. This might be due to the difficulty to compare the position of the crown of the intruded incisor to that of the adjacent tooth. In addition, at such early stage of root development of the affected tooth, the root dentin is too thin to compare its radio-density to that of the adjacent non-affected incisors. The lateral extraoral radiograph in these cases can be the only means to determine the alignment of the root.

Among the six steps of evaluation in which disagreement between evaluators was found, five were in step 3. This emphasizes even more the limitation of the lateral extraoral radiograph.

Different means should be developed to assist diagnosis when the clinical examination and the periapical radiograph cannot answer the question: "does the root of the intruded primary incisor apply pressure on its permanent successor?"

## Conclusions

Lateral extraoral radiographs should not be used routinely in cases of intrusion of primary incisors. The operator should base his or her diagnosis on clinical findings and examination of a periapical radiograph.

The lateral extraoral radiograph should be taken only when its expected contribution to diagnosis can be confirmed, as in cases of children younger than 20 months.

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