Case Report

Orthodontic Repositioning of an Intruded Maxillary Central Incisor in a Middle-Aged Adult Patient: A Case Report

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Abstract

This report demonstrates the orthodontic management of a 50-year-old Thai woman presenting with intrusive luxation of the maxillary left central incisor due to an accident. The patient was referred by the endodontic department for orthodontic extrusion, as root canal access was not possible. Although there were some other orthodontic problems, the patient only needed to reposition the intruded tooth. Adjunctive orthodontic treatment employing standard fixed appliances was commenced to extrude the luxated incisor while limiting undesired movement of neighbouring teeth. A combination of elastic thread mechanics and a piggyback wire configuration was adopted. After 15 months of active treatment, the tooth was successfully repositioned, resulting in improved anterior alignment and enhanced smile esthetics, although an increase in overjet was observed. Mild apical root resorption of the injured tooth was observed after treatment, and cephalometric analysis revealed labial displacement of the incisor without a discernible change in its inclination. With both fixed and removable retainers, the patient entered the retention phase. This case demonstrates that adjunctive orthodontic treatment, specifically the use of elastic thread mechanics in a piggyback configuration, can effectively achieve extrusion of an intruded incisor in an adult patient while minimizing the impact on adjacent teeth.

Keywords: Adjunctive therapy, Collaborative endodontic and orthodontic treatment, Intrusive luxation

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Introduction

Traumatic dental injuries (TDIs) are relatively common and considered to be an important public health issue because they can happen at any time and often lead to long-term problems. Research shows that about one in four school-aged children and nearly one in three adults have experienced dental trauma, with the upper front teeth being most frequently affected.[1] Everyday situations such as accidental falls, work-related accidents, or pre-existing dental conditions can increase the risk. In particular, people with a large overjet are more likely to suffer dental trauma compared to those with normal occlusion, making this a concern across all age groups, not only in the young.[2]

Intrusive luxation is one of the most serious types of injuries. It happens when a tooth is luxated into the alveolar bone after an accident. Although intrusive luxation accounts for only 0.3–1.9% of all dental traumas, it can cause severe damage to the surrounding tissues,

including the periodontal ligament, root surface, pulp, and bone. This can lead to complications such as tooth fracture, pulp necrosis, root resorption, and ankylosis.[3,4]

The International Association of Dental Traumatology (IADT) provides treatment guidelines based on the root development and severity of the intrusion. In immature teeth, spontaneous re-eruption is preferred. In fully developed teeth, surgical repositioning or orthodontic extrusion are the main options. For mild intrusion (<3 mm), a short observation period is recommended to see if the tooth re-erupts naturally; if not, orthodontic traction should be used. For moderate intrusion (3–7 mm), surgical or orthodontic repositioning may be considered, despite the risk of pulp and root complications.[5,6]

Successful management requires quick action and teamwork. Collaboration between orthodontists and endodontists is important for correct diagnosis, proper treatment planning, and better long-term outcomes. This case report presents the orthodontic management of an intruded maxillary central incisor and highlights the value of a team-based approach in handling such complex injuries.

Case report

A 50-year-old Thai woman visited the endodontic clinic with concerns about an intruded maxillary left central incisor. The injury had occurred around two weeks earlier when she fell and hit a staircase, forcing the tooth into the alveolar bone. She reported experiencing mild pain during the first week post-injury without any tooth mobility, but the discomfort had since subsided. The patient had no underlying disease and drug allergies. On examination, the tooth crown was mostly submerged in the gingiva, making standard root canal access impossible. Consequently, she was referred to the orthodontic clinic for orthodontic extrusion. Even though there were other orthodontic problems, the patient only needed to focus treatment on the affected tooth.

Extraoral examination revealed a symmetrical mesofacial facial type with a convex profile consistent with maxillary prognathism. At rest, the lips were naturally closed, and the smile line appeared within normal limits upon smiling (Fig. 1). No signs of temporomandibular joint disorder were observed.[7]

Figure 1 *Pre-treatment extraoral examination*

Intraoral examination revealed symmetrical dental arches with mild to moderate anterior crowding. The patient exhibited an increased overjet of 7 mm and a normal overbite of 3 mm. Molar relationships could not be assessed due to the absence of both lower first molars. Canine relationships were classified as Class II, measuring 6.5-7 mm on both sides. No dental interferences or functional shifts were noted. Oral soft tissues appeared normal, with adequate attached gingiva. The periodontal condition was diagnosed as gingivitis on a reduced periodontium (Fig. 2).

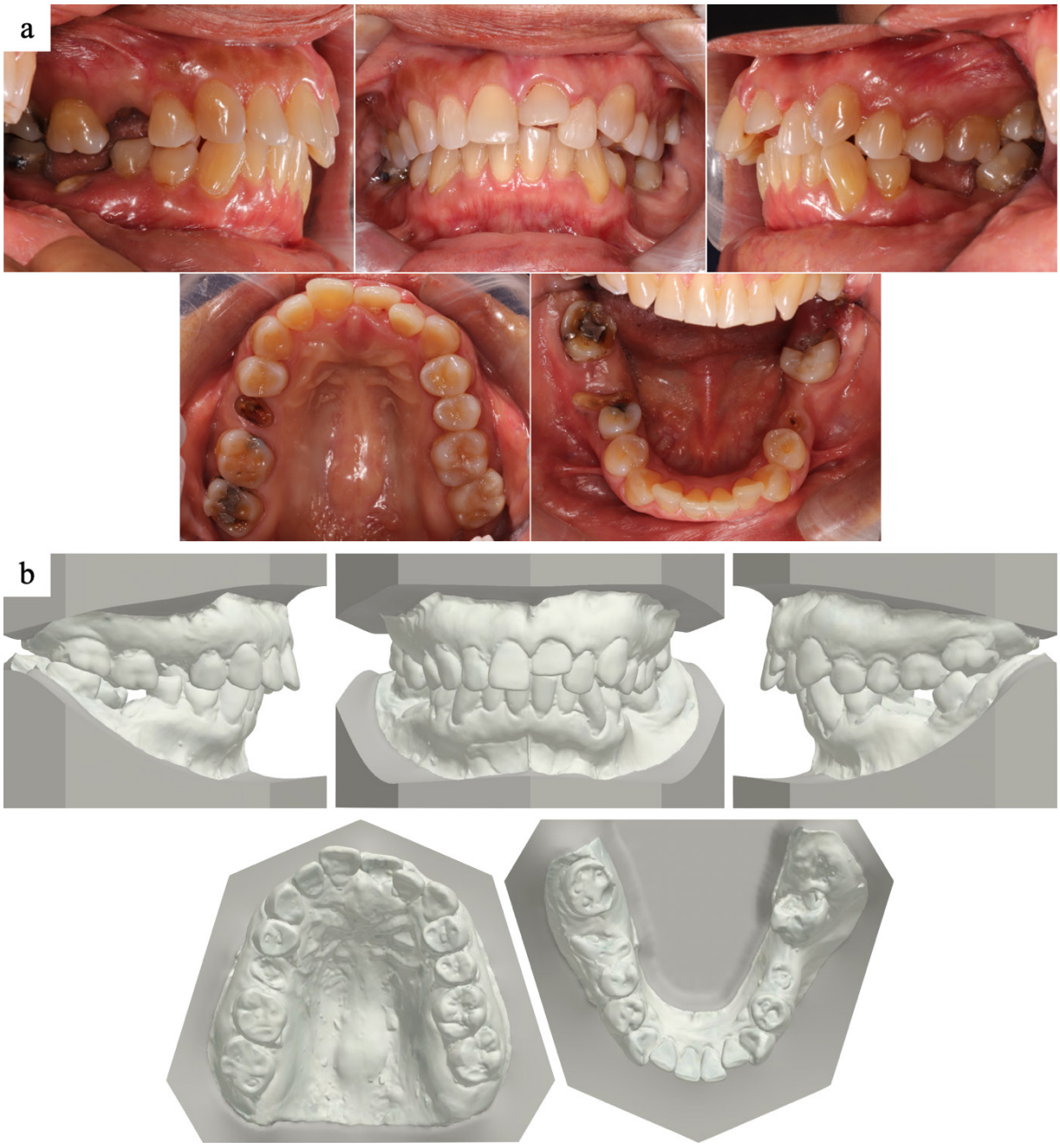

Figure 2 *Pre-treatment records: (a) intraoral examination; (b) dental models.*

The maxillary left lateral incisor was intruded approximately 4 mm into the alveolar bone. Percussion testing elicited no pain and produced no metallic sound. The tooth showed no mobility, and vitality testing yielded a negative response. There were no signs of crown discoloration, cracks, or fractures. The surrounding gingival tissue appeared thickened, with slight bleeding at the gingival margin, although the overall color remained a healthy pale pink.

Periapical radiographs of the injured incisor showed no signs of crown or root fractures, root resorption, or ankylosis (Fig. 3a). Lateral cephalometric analysis revealed a skeletal Class II hyperdivergent pattern, with a prognathic maxilla and an orthognathic mandible.[7] The upper incisors were normally positioned and inclined, including the intruded tooth, which had a similar inclination to adjacent teeth (Fig. 4).

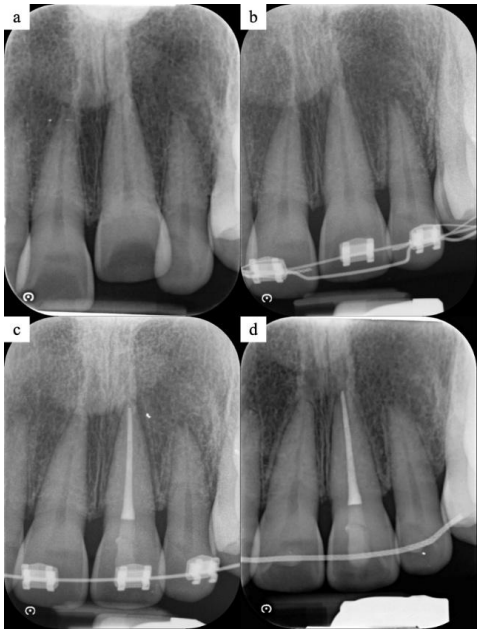

Figure 3 *Sequential periapical radiographs of the left maxillary central incisor obtained at different treatment stages: (a) before orthodontic treatment; (b) before root canal therapy; (c) immediately after root canal therapy; and (d) after completion of orthodontic treatment*

Figure 4 *Pre-treatment lateral cephalogram*

The overall prognosis of the intruded maxillary left central incisor was considered favorable, as clinical and radiographic findings suggested that orthodontic management could be successfully undertaken. The patient preferred treatment limited to extrusion of the intruded tooth, avoiding involvement of other teeth. Thus, the treatment goal was controlled orthodontic extrusion of the maxillary left central incisor supported by adjunctive orthodontic therapy.

A bi-dimensional Roth bracket system was employed in a passive configuration, with slot sizes of 0.018" × 0.022" for anterior teeth and 0.022" × 0.028" for canines and first premolars. All maxillary teeth except the intruded central incisor were passively engaged with a 0.016" stainless steel archwire for one month. The archwire was then replaced with a 0.018" stainless steel wire, and the displaced tooth was extruded using an elastic thread delivering approximately 60 grams of force. As the crown approached the bracket slot level, alignment continued with a 0.012" nickel-titanium wire in a piggyback configuration. Once leveling was completed, the archwire was changed to a passive 0.016" × 0.016" stainless steel wire. At this stage, the lingual surface of the intruded incisor had reached the cingulum level. The patient was subsequently referred to the endodontic department for root canal treatment, which was initiated approximately seven months after the start of orthodontic extrusion. Figures 3b and 3c showed radiographs taken before and after treatment. After complete endodontic therapy, orthodontic adjustments were continued until the incisal edge reached the anterior occlusal plane (Fig. 5).

Following 15 months of treatment, extraoral assessment showed that the patient maintained the same vertical facial proportions and continued to exhibit a convex facial profile. Smile analysis demonstrated significant improvement in tooth alignment compared to pre-treatment, although the dental midline remained unchanged (Fig. 6). Intraoral examination confirmed successful extrusion and proper positioning of the luxated tooth. Although anterior alignment improved, the overjet increased. The final occlusion remained Class II for both canines and molars, with the overjet still enlarged (Fig. 7).

Periapical images taken one year after completion of root canal therapy showed properly obturated canals, with slight external root resorption and widening of the periodontal ligament space noted on the mesial root surface but no periapical pathology (Fig. 3d). The lateral cephalometric radiograph revealed diagnostic characteristics consistent with those observed prior to treatment (Fig. 8). This was confirmed by cephalometric comparison demonstrating stable skeletal and dental relationships before and after treatment (Table 1).

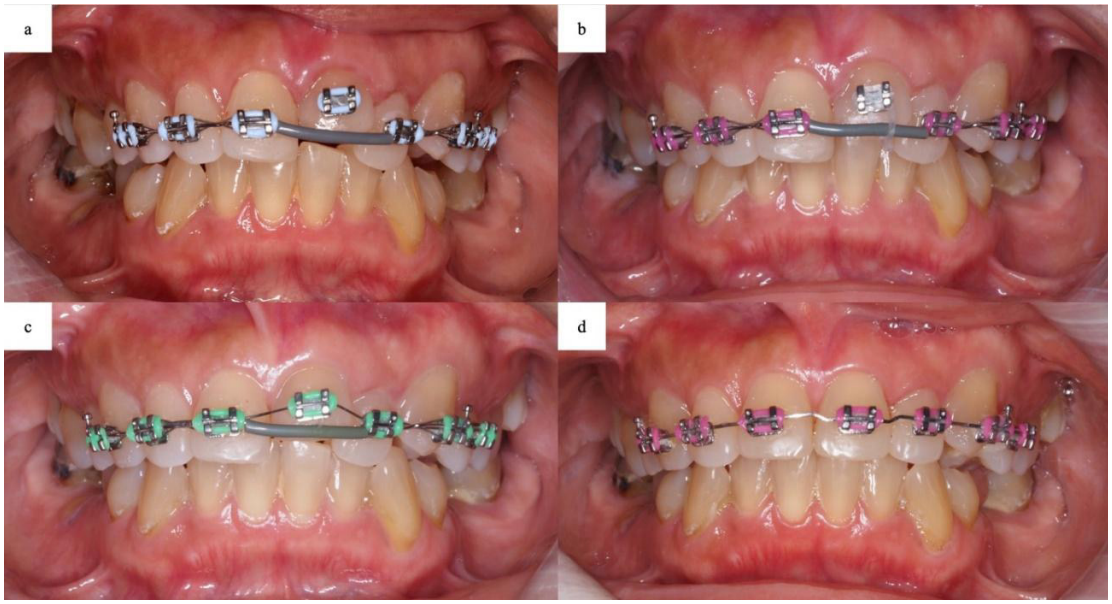

Figure 5 *Sequential mechanics for extruding the upper left central incisor: (a) passive 0.016-inch stainless steel wire, (b) elastic thread applied for extrusion, (c) piggyback setup with 0.012-inch nickel-titanium wire, and (d) additional bend placed in the 0.016 × 0.016-inch stainless steel wire.*

Figure 6 *Post-treatment extraoral examination*

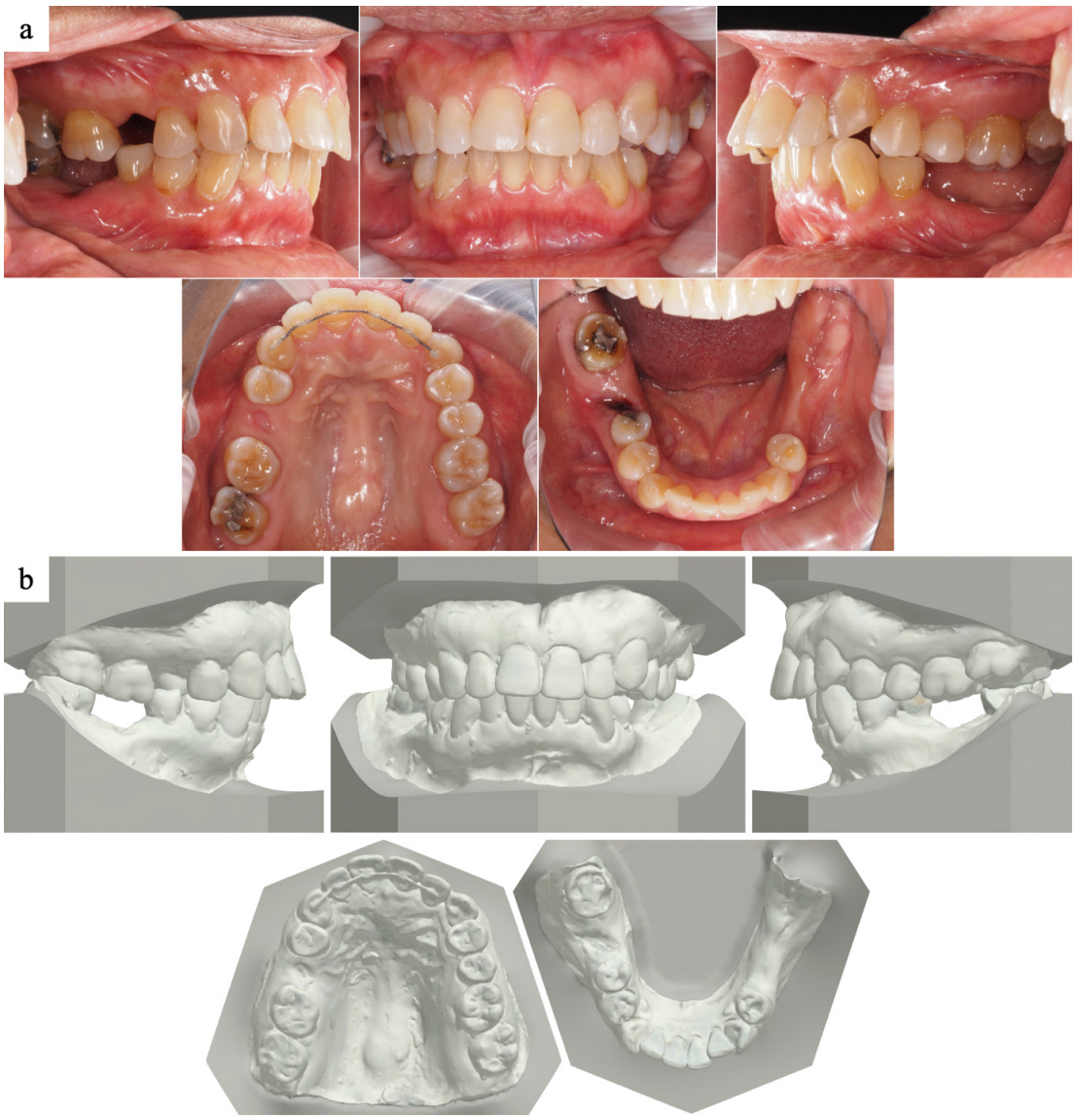

Figure 7 *Post-treatment records: (a) intraoral examination; (b) dental models.*

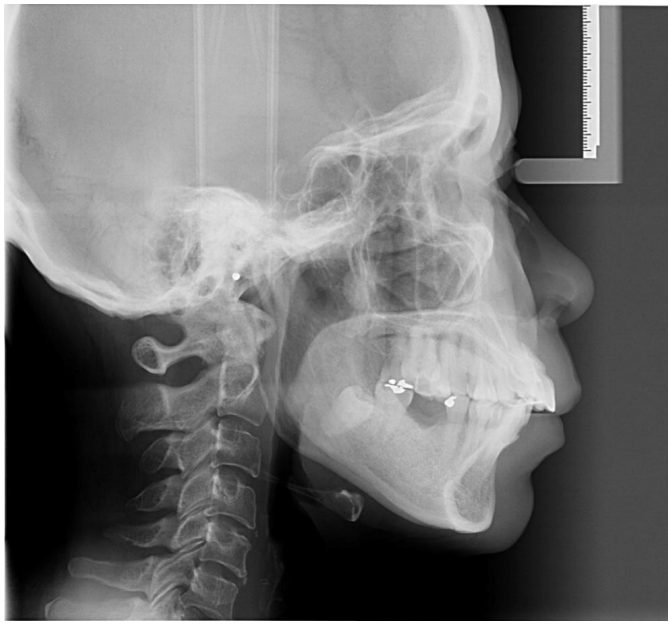

Figure 8 *Post-treatment lateral cephalogram*

Table 1 *Comparison of pre- and post-treatment cephalometric measurements*

	Area	Measurement	Norm Mean±SD	Pre-treatment	Post-treatment	Difference
	Reference line	FH-SN (deg.)[8]	6±3	6	6	0
Skeletal	**Maxilla to cranial base**	SNA (degree)[9]	84 + 4	89	89	0
		A-Nperp (mm)[10]	5±4	5.5	5.5	0
		SN-PP (degree)[10]	9±3	12.5	12.5	0
	Mandible to cranial base	SNB (degree)[9]	81±4	81	81	0
		Pg-Nperp (mm)[10]	0±6	-6	-6	0
		SN-Pg (degree)[9]	82±3	80	80	0
		SN-MP (degree)[9]	29±6	41	41	0
		NS-Gn (degree)[9]	68±3	72	72	0
	Maxillomandibular	ANB (degree)[9]	3±2	8	8	0
		Wits (mm)[8]	-3±2	1	1	0
		FMA (degree)[10]	23±5	35	35	0
		MP-PP (degree)[9]	21±5	28.5	28.5	0
Dental	**Maxillary dentition**	U1 to NA (degree)[9]	22±6	22	22	0
		U1 to NA (mm)[9]	5±2	5	6	+1
		U1 to SN (degree)[9]	108±6	110.5	110.5	0
		ADH (mm)[11]	27.23±2.79	30	30	0
		PDH (mm)[11]	22.24±2.23	20.5	20.5	0
	Mandibular dentition	L1 to NB (degree)[9]	30±6	40.5	40.5	0
		L1 to NB (mm)[9]	7±2	11	11	0
		L1 to MP (degree)[8]	99±5	98	98	0
	Maxillomandibular	U1 to L1 (degree)[9]	125±8	109	109	0
Soft tissue	**Soft tissue**	E line-U. lip (mm)[10]	-1±2	3.5	4	+0.5
		E line-L. lip (mm)[10]	2±2	4	4	0
		NLA (degree)[8]	91±8	91	90.5	-0.5
		H-angle (degree)[9]	14±4	24	24.5	+0.5

Superimposition on the cranial base showed no growth-related changes at the nasion or basion, nor any positional shifts in the maxilla or mandible. Maxillary superimposition revealed that the upper incisors had protruded (Fig. 9), and model analysis[13] confirmed incisor protrusion along with expansion of the dental arch (Fig. 10).

Following debonding of all orthodontic appliances, the treatment progressed to the retention phase. To maintain the achieved tooth positions, both a fixed retainer and a removable wraparound appliance were provided (Fig. 11). The patient was instructed to wear the removable retainer full-time, removing it only during meals and oral care. Follow-up visits were scheduled at one week, one month, and three months post-debonding, and then every six months to monitor function, esthetics, and stability. Throughout the recall period, the anterior tooth relationship remained stable. However, no routine radiographic follow-up was performed, and additional radiographs were obtained only when clinically indicated. The patient demonstrated excellent compliance with the retainer regimen and strong motivation to maintain the orthodontic results.

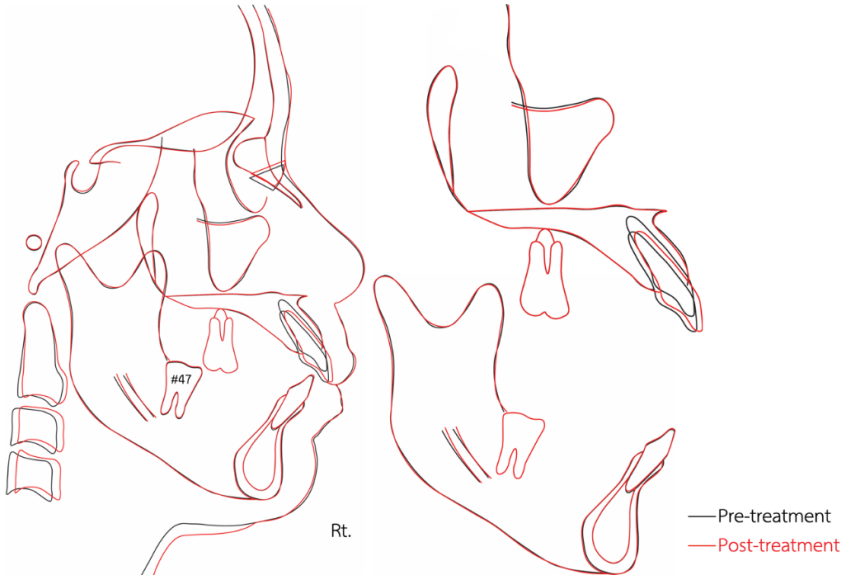

Figure 9 *Cephalometric superimposition of pre-treatment (black) and post-treatment (red) tracings.*

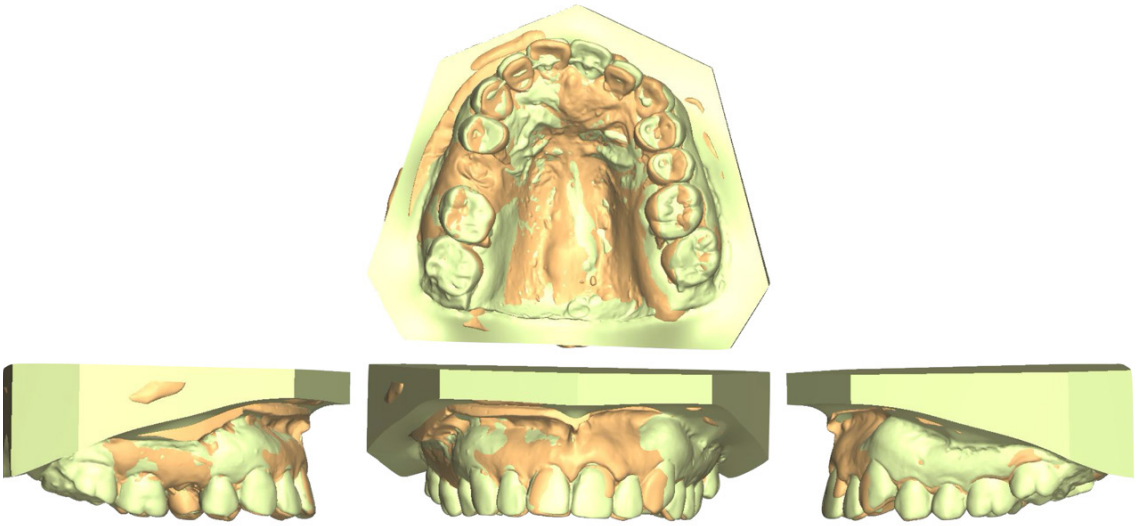

Figure 10 *Maxillary dental model superimposition of pre-treatment (orange) and post-treatment (green) using third palatal rugae as references*[13]

Figure 11 *Post-treatment retention appliances*

Discussion

The management of intrusive luxation is one of the most complex and complicated traumatic dental injuries. The prognosis depends on several factors, including the degree of intrusion, stage of root development, time elapsed before treatment, and the treatment modality chosen. In the present case, the patient was a middle-aged adult with a fully developed permanent dentition, and the maxillary left central incisor was intruded approximately 4 mm. According to International Association of Dental Traumatology (IADT) guidelines, orthodontic extrusion is the preferred treatment in such moderate intrusion cases, since spontaneous re-eruption is unlikely in teeth with complete root formation.[6]

The treatment objectives focused on controlled extrusion of the affected tooth while minimizing additional trauma to surrounding tissues. A bi-dimensional Roth appliance was selected to enhance torque control and allow precise modulation of force magnitude during orthodontic repositioning of the traumatized tooth, with light orthodontic forces delivered using elastic thread and piggyback mechanics. Previous studies have emphasized that the use of light forces is critical to reduce the risk of root resorption and ankylosis.[14] Therefore, light orthodontic force was applied for the extrusion of the intruded tooth in this case. The maxillary first premolars were used as anchorage to provide sufficient support for controlled extrusion. A 0.018-inch stainless steel archwire was selected to enhance anchorage stability, and an elastic thread delivering approximately 60 g of force was applied. As extrusion progressed, a 0.012-inch nickel-titanium wire was added in a piggyback configuration to facilitate alignment while minimizing adverse effects.

Endodontic management is also crucial in intrusive luxation cases, as the risk of pulp necrosis is high in mature teeth. In this patient, root canal therapy was initiated after partial orthodontic extrusion. This sequence facilitated effective interdisciplinary collaboration, allowing timely endodontic intervention once adequate canal access was achieved. This makes it simpler to get to and keeps the area drier, which makes endodontic therapy perform better overall. Radiographs taken following treatment showed that the recovery was going well. There was slight external root resorption and no signs of periapical lesion. Long-term follow-up for at least five years has been planned. Periodic clinical evaluation will be performed, with radiographic assessment if clinically indicated, to detect potential late complications such as external root resorption and ankylosis.

From both functional and esthetic perspectives, the treatment successfully repositioned the intruded tooth. No additional restorative intervention was required, as the tooth structure and esthetics remained satisfactory following orthodontic and endodontic treatment. Although the final occlusion remained Class II with an increased overjet, which was similar to the initial condition along with a slight arch expansion, there was no impact on function or esthetics of the patient. For post-treatment retention, a fixed retainer in combination with a wraparound retainer was used to effectively prevent relapse in both the vertical and anteroposterior dimensions. In repositioning the tooth, anchorage teeth were prepared to be as stable as possible by carefully placing the brackets in appropriate positions and using a passive archwire to maintain tooth alignment. However, achieving an ideal bracket position in every area was not always possible, and the passive archwire could still exert a slight force because its relatively large size fit closely within the bracket slots, thereby transmitting minimal force to the teeth. An additional benefit observed was a slight improvement in the angulation and inclination of the adjacent teeth. This occurred as a secondary effect of using pre-adjusted Edgewise brackets, despite the fact that the archwire had been engaged passively during treatment.

However, some limitations should be acknowledged. The final occlusion remained in a Class II relationship, and the overjet was not improved, accompanied by a minor expansion of the arch. These problems showed how hard it is in practice to balance the best therapeutic goals with patient-centered care.

This case highlights several essential factors for managing intrusive luxation: the need for early intervention,

the application of light orthodontic forces, timely endodontic intervention, and close collaboration with specialists. These factors together could significantly improve the prognosis of such complex injuries, even in adult patients with completed root formation.

Conclusion

This case demonstrated that controlled orthodontic extrusion using light continuous forces, in combination with subsequent endodontic treatment, can provide a predictable and effective outcome. The collaborative approach between orthodontics and endodontics not only facilitated proper tooth repositioning but also ensured optimal conditions for root canal therapy. Although ideal orthodontic correction was limited by the treatment preference of the patient, the primary objective, successful extrusion of the intruded maxillary central incisor, was achieved with satisfactory functional and esthetic results. This case emphasizes the importance of early intervention, force control, and interdisciplinary cooperation in improving the prognosis of intrusive luxation in mature permanent teeth.

Author contributions

TL: Original draft preparation, Manuscript review and editing, Resources; TK: Original draft preparation, Manuscript review and editing; and WR: Manuscript review and editing, Resources.

Ethical statement

Consent from the patient was obtained before publication.

Disclosure statement

The authors have no conflict of interest.

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