Controlled tooth movement to correct an iatrogenic problem

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This case report describes the treatment of a 9-year old boy, who had his maxillary central incisors extruded by noncontrolled elastic mechanics to close a diastema. The article describes the consequences of this movement and how the problem was solved with controlled intrusion. (Am J Orthod Dentofacial Orthop 2011;139:271-8)

Broadbent1 first described the “ugly duckling stage” of dental development in the literature. Profitt and Fields2 reported that this stage is characterized by diastemas in the maxillary arch. The central diastema tends to close as the lateral incisors erupt, but the diastema can persist even after eruption is complete. This situation occurs so frequently that it is considered normal. For this reason, the mixed dentition can be a difficult time for children, their parents, and the orthodontist; as the child’s permanent teeth erupt, his or her smile is not as esthetic as it was during the deciduous dentition. Parents often worry about dental spacing, and the orthodontist must explain that this unesthetic period is normal and is not to be treated at that time.

Unfortunately, not every dentist is familiar with this stage and the correct way to handle the situation; as a result, the patient can suffer the consequences. This case report describes this type of situation and the orthodontic treatment necessary to overcome a serious problem.

DIAGNOSIS AND ETIOLOGY

A 9-year-old boy came to the orthodontic clinic at Rio de Janeiro State University in Brazil complaining that his maxillary central incisors were extruded. He had a straight profile and good facial proportions. The clinical examination showed that he was in the mixed dentition, with a Class I molar relationship and crossbite of the maxillary lateral incisors, the right deciduous canine, and the right deciduous first molar. The midline was shifted 2 mm to the left in both arches. There was an overjet of 3 mm and a mild curve of Spee.

But the most significant anomaly was the extreme extrusion of the maxillary central incisors with advanced gingival recession around these teeth (Fig 1). His mother mentioned that he previously had a wide gap between those teeth, and she took him to a dentist who recommended placing a rubber band around the 2 teeth to close this space. The elastic disappeared every night, and the dentist told him to put another in its place. The mother suspected that something was not right and decided to ask for a second opinion.

At this point, the central incisors had extruded about 6 mm and were extremely mobile. He had gingival hyperplasia, bleeding on probing, and deep pockets around the incisors. The elastics kept disappearing, because they were sliding up along the periodontal ligament space and gradually extracting the teeth. A panoramic radiograph showed the presence of all permanent teeth. An anterior periapical radiograph showed significant loss of bone around the central incisors, and the roots of the central incisors were in contact (Fig 2).

TREATMENT OBJECTIVES

The long-term prognosis for the central incisors was poor, but we decided to maintain these teeth as long as possible. So, the treatment objectives at this first stage were to remove the elastics from beneath the gingiva, intrude the central incisors, and align their roots to improve the bone support in this area.
**TREATMENT ALTERNATIVES**

An alternative treatment plan—extracting the central incisors by extruding them slowly to bring bone with the teeth and thereby improve the bone defect—was ruled out. The patient would need to wait several years before permanent restoration with implants would be possible.

**TREATMENT PROGRESS**

The central incisors were splinted, and a surgical procedure was used to remove the elastics (Fig 3). When the flap was elevated, the bone loss, mainly on the facial side, was evident. During surgery, no scaling was performed on the roots to maintain any remnants of the periodontal ligament. Only superficial cleaning was performed to avoid damaging the cementum and, we hoped, allow future replacement of the fibers of the periodontal ligament. The inflammatory tissue was removed, and the flap was repositioned. A rigid oral hygiene program was adopted.

When the periodontal health had improved, brackets were bonded to the 2 central incisors, and bands were cemented on the maxillary first molars. A utility

0.019 × 0.025-in stainless steel archwire was used to intrude the incisors. After 6 months, both central incisors had been intruded to normal positions, and their mobility had decreased significantly. However, the roots were
still in close proximity. At that time, we stopped the intrusion mechanics and placed another segmented 0.019 × 0.025-in archwire on the central incisors with small artistic bends to tip the roots distally and create space between them (Fig 4). Two months later, the radiograph showed a small space between the roots with bone formation in the area (Fig 5).

Then the patient suffered trauma to the maxillary incisors, and we decided to stop the tooth movement and monitor tooth mobility to assess for clinical signs of ankylosis. However, the teeth did not ankylose. The brackets were removed, tooth positions were retained, and we waited for the remaining permanent teeth to erupt before starting the second phase of treatment.

The second stage began when the patient was 12 years old. At this time, he had a dental and skeletal Class I malocclusion, maxillary and mandibular dental protrusion, a 3-mm extrusion of the maxillary incisors, and a crossbite of the lateral incisors, the first premolars, and the maxillary left first molar (Figs 6-8).

The objectives in the second phase of treatment were (1) to correct the anterior and posterior crossbites by using a Porter appliance with digital springs for the lateral incisors, (2) to intrude and correct the root angulations of the maxillary central incisors by using a beta-titanium alloy segmented archwire combined to a Burstone intrusion arch,3 and (3) to begin leveling and aligning the buccal segment by using nickel-titanium segmented archwires.

As soon as the central incisors were positioned, a continuous archwire was used to level and align the arch. The mandibular arch was leveled and aligned with
constricted stainless steel archwires. During treatment, the patient developed a Class III growth tendency, and it was necessary to use Class III elastic mechanics. A 0.036-in buccal expanded maxillary archwire and a nighttime facemask were used to camouflage the Class III tendency and prevent traumatic contacts to the maxillary central incisors. The treatment was finished, and the appliances were removed.
TREATMENT RESULTS

The patient’s dental esthetics were improved, the molar relationship was preserved, and the periodontal situation around the central incisors was much healthier. Overjet and overbite were corrected as well as the crossbites. A cone-beam computed tomography image obtained 3 years after appliance removal showed significant bone formation around these teeth (Figs 9-12).

DISCUSSION

This patient’s malocclusion should have been easy to treat, with a good prognosis. However, because of the misuse of the rubber bands and the wrong diagnosis, it became difficult, with doubts about the future of the central incisors. Correct diagnosis is an important step for good orthodontic treatment. A midline space could result from any of several possible causes: eg, midline supernumerary tooth, thick labial frenum, or intrabony lesion. A maxillary occlusal or periapical radiograph would show whether there was a pathologic condition in the area, and whether any treatment would be needed at that stage of development.

Even if diastema closure were indicated, the dentist who treats the patient must understand the basic orthodontic mechanics that are essential for optimum orthodontic treatment. Force, center of resistance, moment, couple, and center of rotation are fundamental to safe tooth movement. When the dentist told this boy to use elastics around the incisors, he induced a movement without control of any of these factors and produced severe bone resorption and extrusion of the incisors. The periodontal ligament and the alveolar bone were completely destroyed on the buccal, distal, and lingual.
Fig 10. Dental casts after the second stage of treatment.

Fig 11. Final radiographs.
surfaces. On the mesial surface, the roots were approximated and caused a severe bone defect. But, fortunately, the periodontal ligament was preserved.

Extrusion is an easy movement, since it produces few areas of compression. Extrusion should not be performed with heavy forces unless the goal is to extract the tooth rather than to bring alveolar bone along with the root.4 This almost happened with this patient, who had his incisors so heavily extruded that it was impossible to predict their prognosis. In the literature, teeth with that much extrusion, mobility, and bone loss are typically extracted.

Orthodontic intrusion was considered impossible for many years. However, clinically successful intrusion has been demonstrated in the literature; it requires careful control of force magnitude and direction so that light forces are applied to the teeth to prevent root resorption.5 In our patient, we decided to preserve the incisors and intrude them with controlled mechanics. While this movement was occurring, radiographs were taken routinely to make certain that the movement was well controlled and favorable. Even though the amount of intrusion was significant, there were no other good alternatives. The intrusion improved the periodontal health by removing trauma from those teeth. After they had been extruded, they were being traumatized by the opposing teeth.

Artun et al5 reported that bone formation could occur with this type of tooth movement, but at the beginning of the treatment we did not have a cone-beam computed tomography image for comparison with the end of treatment image. Although the bone level was poor at the end of the treatment, the soft tissue looked reasonably good. Melsen6 reported that new insertion of the periodontal ligament associated with orthodontic intrusion can happen. A possible explanation for this would be that the orthodontic movement leads to the formation of a long-junctional epithelium beneath the alveolar bone level.

The 2 central incisors that were reintruded have been monitored for 3 years after treatment, and they seem stable and have normal mobility. If implants are needed eventually, at least the patient will be old enough to receive them with a good prognosis, and he will have spent his adolescence with his own incisors and not artificial teeth. In the future, if the prognosis of these incisors changes and implants are necessary, the incisors could be extruded slowly to create vertical bone and improve the implant results.

CONCLUSIONS

Tooth movement can be responsible for bone formation and for bone loss, depending on its control. This case is an example of how uncontrolled movement can
harm a patient and how good orthodontic planning can rescue hopeless teeth.

REFERENCES