Case Report

Treatment of a Patient with Multiple Impacted Teeth

Richard Scott Conley[a]; Scott B. Boyd[b]; Harry L. Legan[c]; Christopher C. Jernigan[d]; Craig Starling[e]; Christopher Potts[f]

ABSTRACT

An impacted or missing permanent tooth can add significant complications to an otherwise straightforward case. When multiple impacted teeth are present, the case complexity increases further. Developing a treatment sequence, determining appropriate anchorage, and planning and executing sound biomechanics can be a challenge. The following case report illustrates a patient reportedly diagnosed with mild scleroderma as an adolescent. He presented for orthodontic treatment as an adult with multiple retained primary teeth and multiple impacted teeth. Diagnosis, treatment planning, and various methods of managing guided eruption of impacted teeth will be discussed. Following orthodontic treatment that required extraction of multiple primary and permanent teeth as well as exposure and ligation of multiple permanent teeth by an oral surgeon, the patient finished with a significantly improved functional and esthetic result.

KEY WORDS: Diagnosis and treatment planning; Impaction; Guided eruption

INTRODUCTION

Dental impaction has been reported to affect as much as 25% to 50% of the population.[1] Maxillary canine impaction occurs in approximately 1% to 3% of the population with a 2:1 female to male ratio.[2,3] The maxillary canines are more commonly impacted than the mandibular canines.[4] Other teeth may be impacted, but less frequently.[5] Potential factors related to impaction include crowding, maxillary transverse deficiency, missing or peg lateral incisors, and physical impediments such as mesiodens, odontomas, or supernumerary teeth.[6–10]

Impacted or missing teeth can add significant complexity to treatment, particularly in the maxilla with the maxillary canine the most common impacted tooth.[11,12] One palatally impacted canine can significantly lengthen the overall treatment time; multiple impactions compound the problem. Age at the start of treatment, palatal vs buccal positioning, and the distance of the tooth from the occlusal plane are factors reported to increase treatment time and complexity.[13,14] Finally, certain syndromes demonstrate a higher incidence of impacted teeth.[15,16] The most common syndrome is cleidocranial dysplasia.[17,18]

Patients with multiple impactions need coordinated management to guide eruption of as many teeth as possible. Those that cannot be brought into the arch may require extraction followed by either space closure or prosthetic replacement. The following case is significant because most previous reports demonstrate fewer impacted teeth, younger patients, and teeth with open apices, which are reportedly more amenable to successful treatment.[19]

History and Diagnosis

DW, a 34-year-old white man initially presented to the Vanderbilt University Medical Center Division of Orthodontics in March 2002. His chief complaint was, ''I have a lot of baby teeth left and want my bite fixed.'' The patient reported an unremarkable medical history with no known allergies and no known adverse drug reactions. When questioned further, he revealed a diagnosis of ''mild scleroderma'' as a teenager. Confirmation with the primary care physician who diagnosed mild scleroderma was attempted, but was not made.

[a] Clinical Assistant Professor, Department of Orthodontics and Pediatric Dentistry, University of Michigan School of Dentistry, Ann Arbor, Mich.

[b] Professor, Department of Oral and Maxillofacial Surgery, Vanderbilt University Medical Center, Nashville, Tenn.

[c] Professor, Division of Orthodontics, Vanderbilt University Medical Center, Nashville, Tenn.

[d] Private Practice, Columbia, SC.

[e] Private Practice, Brentwood, Tenn.

[f] Private Practice, Goldsboro, NC.

Corresponding author: Dr Richard Scott Conley, Department of Orthodontics and Pediatric Dentistry, University of Michigan School of Dentistry, 1011 N University Avenue, Ann Arbor, MI 48109-1078.
(e-mail: rsconley@umich.edu)

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Figure 1. Pretreatment photographs. Note the retained primary teeth and the clinical absence of the permanent teeth. Normal eruption of the permanent canines and premolars typically occurs by the age of 12–13 years, and the patient was 34 years of age at the start of treatment.

DW's clinical examination revealed a Class I molar relationship with multiple retained primary teeth (Figure 1). The mandibular right and left second primary molars were submerged with altered response to percussion and considered ankylosed. Both dental arches were broad. DW had 30% overbite with lingually inclined mandibular incisors. The curve of Spee was 1–2 mm and mild arch length deficiencies were present. The maxillary tooth to lip relationship was normal with no interlabial gap at rest. An area of minimally attached gingiva in both the lower canines and the lower left central incisor was present. Otherwise, the gingiva appeared healthy.

Radiographically, the full permanent dentition was present (Figure 2). The mandibular right third molar was horizontally impacted and lying directly over the inferior alveolar nerve. The other three third molars were less severely impacted. The mandibular left and right canines and the left first premolar had erupted into the oral cavity, but were submerged and classified as impacted. The mandibular left and right second premolars had essentially full roots and were impacted beneath the primary second molars. The mandibular right first premolar buccal cusp was barely visible and lodged beneath the mesial aspect of the primary second molar. In the maxilla, the permanent canine, first premolar, and second premolar were impacted bilaterally.

Cephalometrically, the maxilla was well positioned and the mandible was slightly forward. A Class III apical base relationship (AB-OP: +6) was present.[20] DW was diagnosed with a Class I dental, mild Class III

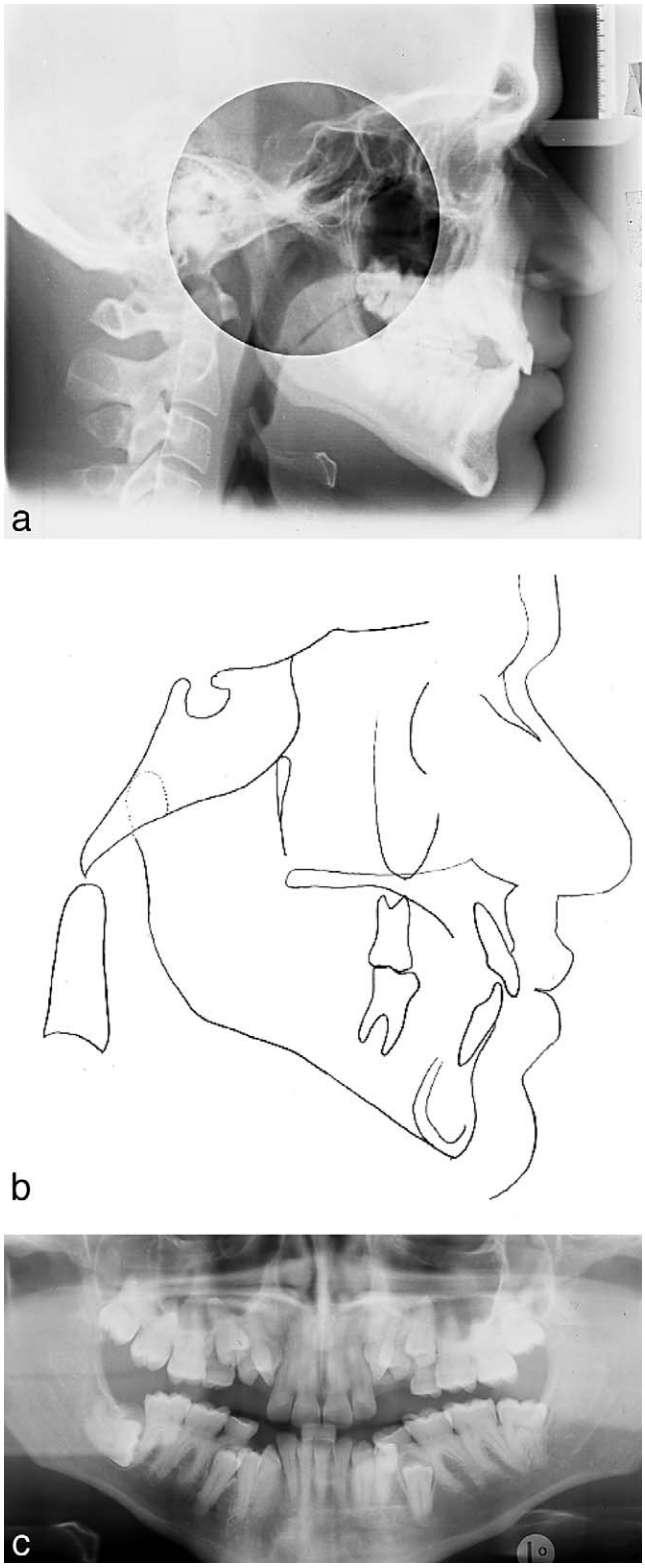

Figure 2. Pretreatment radiographs including the lateral cephalometric and panoramic films. A mild Class III skeletal relationship is present with A-B to OP +6. Note the presence of the permanent teeth, the significant root development, but the failure for these nine permanent teeth to erupt into the oral cavity.

skeletal malocclusion with multiple impacted teeth, and a mild arch length deficiency.

Treatment Objectives

The main treatment objective was guided eruption of the impacted teeth to obtain a functional occlusion. The orthodontic treatment plan required full fixed orthodontic therapy in coordination with oral surgery to expose and ligate the nine impacted teeth. The patient was informed that, due to the underlying Class III apical base relationship with compensated incisors, he might require orthognathic surgery.

The patient expressed interest in orthodontic therapy, but not surgery. He stated that if an anterior crossbite developed he would accept the improved alignment and forgo surgery. As part of his informed consent he was advised that extraction of one or more impacted teeth might be necessary if ankylosis had occurred. Restorative treatment was proposed to address this eventuality. He was referred to a maxillofacial prosthodontist prior to treatment to investigate a potential backup plan.

Treatment Alternatives

The patient had previously been informed that prosthodontic therapy might be his only option. A treatment alternative included extraction of the primary teeth leaving the impacted permanent teeth to assist in maintaining adequate bone stock for an overdenture. This remained a potential treatment alternative, however, as the patient was still young and concerned about long-term cost and frequency of replacement restorations that might be needed over his lifetime. The patient preferred the orthodontic approach as it had the potential to fully correct the problem with just one stage of treatment.

Treatment Progress

Prior to placing fixed orthodontic appliances, the patient underwent extraction of the retained primary teeth and three of the four third molars (1, 16, and 17). The lower right third molar (32) was not extracted due to its proximity to the inferior alveolar nerve. The surgeon expressed that the risks from extraction were greater than the risk of maintaining the tooth. The tooth was observed without incident during treatment.

Orthodontic appliances were placed one week after extraction. A 0.022 $\times$ 0.028 inch slot preadjusted appliance was bonded to the available teeth and light continuous arch wires were placed. After six months with continuous arch wires, the patient was referred back to the oral surgeon with continuous 0.016 $\times$ 0.022 inch stainless steel arch wires in place. Little to no eruption of the impacted teeth had occurred since extraction of the retained primary teeth.

Figure 3. Intraoral progress photographs. This is approximately four months after exposure and ligation of the nine unerupted teeth. Significant progress has been made, with all of the mandibular permanent teeth now guided into the oral cavity. Continuous stainless steel mandibular and nickel titanium (NiTi) maxillary arch wires are present. The lower pictures illustrate the elastic pattern utilized to assist with further eruption and Class III correction. Typically, elastic traction is not employed with a NiTi wire, but this was an atypical clinical presentation where it was felt the traction with a light wire would be beneficial.

Nine permanent teeth (4, 5, 6, 11, 12, 13, 20, 28, and 29), were exposed and ligated. A full thickness mucoperiosteal flap was used. Once visualized, each impacted tooth was luxated with an elevator. A gold chain was attached to each individual tooth. Prior to flap closure, bond strength and adequacy of luxation was visually inspected to assure mobility. The flaps were sutured back in place with 4-0 chromic sutures. The gold chains passed transmucosally to facilitate closed eruption. The chains were ligated to the stopped maxillary arch wire with a stainless steel ligature. No eruptive force was placed on the day of exposure.

The next day, the patient returned to the orthodontic office. Power thread was placed from each gold chain to the arch wire above the impacted tooth. The patient returned two weeks and four weeks later to replace the power thread. One month after exposure and ligation, a 0.014 nickel titanium (NiTi) overlay wire was placed through the most gingival link of each gold chain. After three months a continuous nickel titanium arch wire was placed in the mandibular arch. One month later (Figure 3), a continuous stainless steel arch wire was placed with 3/16 inch vertical interarch elastics from the lower premolars to the maxillary premolars. As each tooth erupted into the oral cavity, 0.022 $\times$ 0.028 inch brackets were placed as ideally as possible. Seven months after exposure and ligation (Figure 4), brackets were in place on all the previously impacted teeth. A progress panoramic x-ray film (Figure 5) was taken one year after exposure and ligation and the brackets repositioned accordingly. The final six months of treatment focused on correcting the mild

Figure 4. Intraoral photographs seven months after exposure and ligation. All of the teeth have been bonded. The mandibular arch is approaching completion, while the maxillary arch has progressed, but more slowly. A power thread is about to be applied to the maxillary right canine to guide it into the arch.

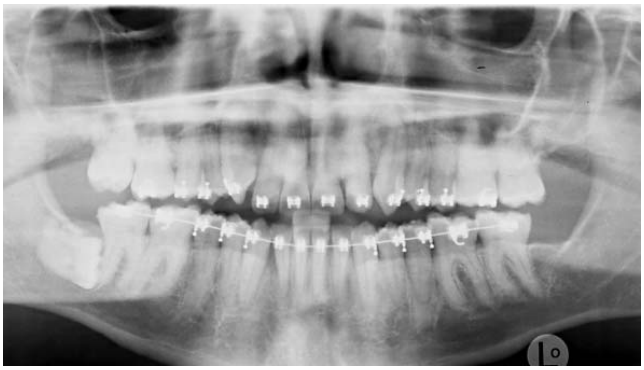

Figure 5. Progress radiograph showing the progress obtained after one year. The maxillary right canine is the furthest from the occlusal plane at this point. Note the impacted mandibular right third molar that was left in place due to its close proximity to the inferior alveolar nerve. The risk of extraction was deemed greater than the risk of leaving the tooth in place. The patient was informed of this as part of his surgical informed consent.

Class III malocclusion and finishing with a well-interdigitated posterior occlusion.

Treatment Results

At 26 months, the patient was extremely pleased with the results that were obtained and requested removal of the appliances (Figures 6 and 7). A well-interdigitated Class I molar and canine relationship was obtained on the left side with a less than 1-mm Class III relationship on the right side. He was informed of the slight deviation from ideal. The patient did not desire further treatment to obtain more ideal occlusal interdigitation and the appliances were removed. The treatment superimpositions showed dramatic eruption of the maxillary and mandibular posterior dentition (Figure 8). Mild proclination of the maxillary incisors occurred due to the underlying Class III skeletal relationship and the dental compensation required to maintain overjet.

Figure 6. Post treatment photographs. A significantly improved occlusion has been obtained with the guided eruption of the nine impacted teeth. Good arch form and good alignment has been achieved.

DISCUSSION

Conditions that change the characteristics of the overlying mucosa could cause eruption anomalies. At present, the orthodontic literature does not reveal any association between scleroderma and eruption anomalies. He was referred for, but did not wish to pursue additional medical testing to confirm the previous diagnosis of mild scleroderma. He did not demonstrate any other signs or symptoms of scleroderma. He did report return appointments to his adult primary care physician, but for routine health maintenance only. Without confirmation, it is unclear if the previously diagnosed scleroderma was a causative, contributing, or unrelated factor. Proffit[21] and others have discussed primary failure of eruption. However, in those cases the primary dentition may have already been shed, the permanent teeth began eruption into the oral cavity and then failed to completely erupt.

A frank discussion with the patient and a parent was performed prior to initiating treatment. One concern was that complete eruption of each impacted tooth might not be possible. He was advised improvement might be observed, but ankylosis could occur anytime during the eruptive process. Should ankylosis occur, he might need a second luxation. If the ankylosis could not be resolved, he was prepared for possible extraction followed by prosthodontic treatment. The patient and his parent were satisfied that all reasonable orthodontic attempts would be made and wished to proceed.

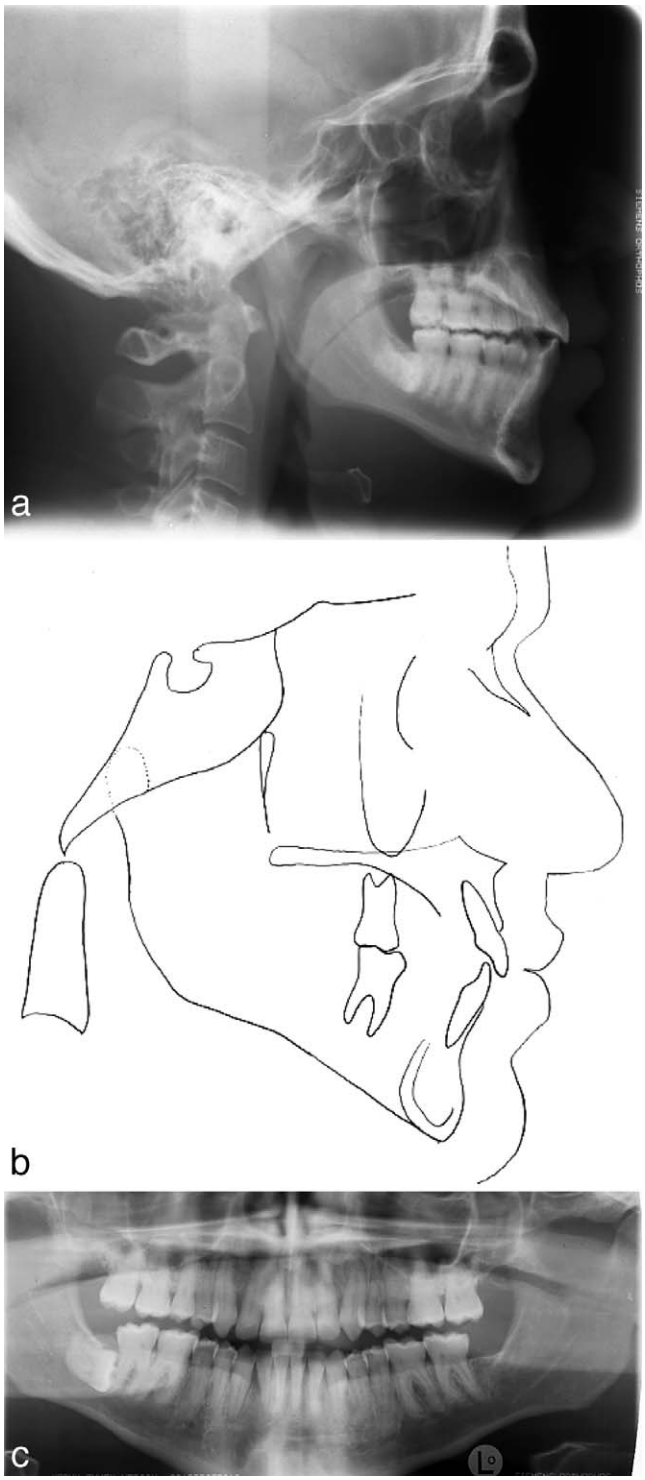

Figure 7. Post treatment radiographs and post treatment lateral cephalometric tracing.

Open eruption can provide better localization of the teeth over closed eruption. In DW's case, due to the multiple impactions in all four quadrants, four large apically positioned flaps would have been required. As a result, closed eruption was deemed a better choice.

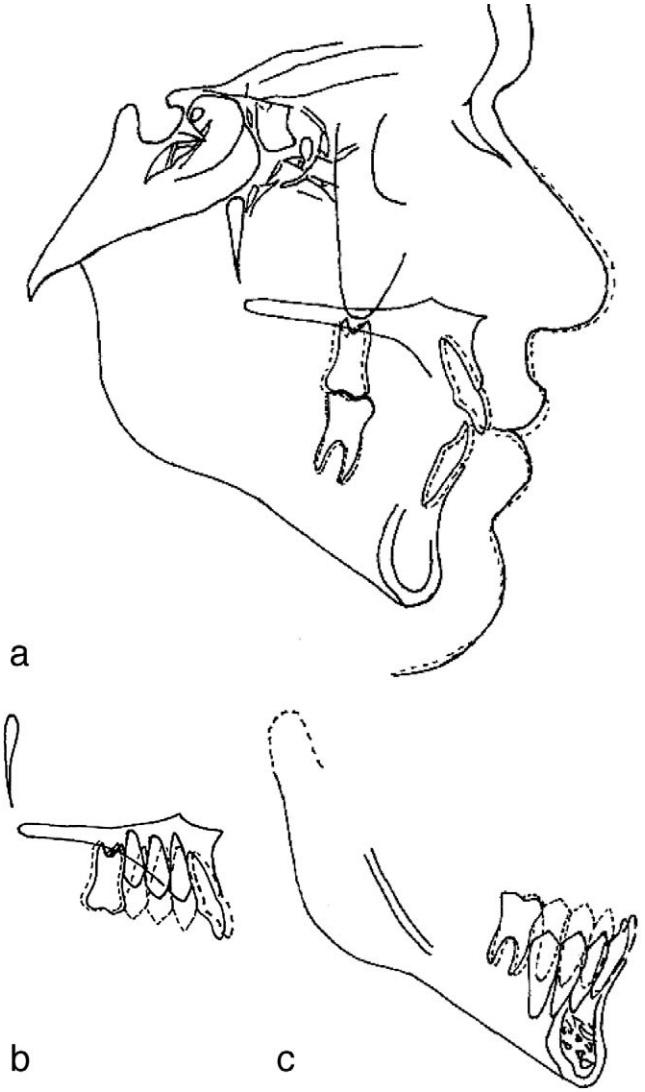

Figure 8. Treatment superimpositions illustrating the significant eruption that occurred in the mid arch of both jaws. The solid line demonstrates the pretreatment position, and the dashed line the post treatment position. Eruption using the methods described enabled creation of a good final occlusion. Mild proclination of the maxillary incisors occurred due to the mild arch length deficiency that existed pretreatment.

Designing and applying an ideal force system relative to the center of resistance of the tooth can be challenging.[22–24] With impactions, and in this case multiple impactions, applying the desired force system is complicated still further. Multiple methods of applying eruptive force to the teeth were utilized and are presented in chronological order. A balance between each method's advantages and disadvantages was sought.

Power thread can provide very light eruptive forces.[25,26] It has the advantage that the light force can be applied to each individual tooth. In DW's case, an open coil spring was placed on the arch wire in the

area of the impacted teeth. The power thread was then ligated from the gold chain to the corresponding area of open coil spring. One drawback is the tendency for the force level from the power thread to decay quite quickly. Within two weeks, the force from the power thread was no longer sufficient to continue eruption. The patient found it too time consuming to visit the office every other week.

Nickel titanium overlay arch wires[27,28] can work well with one impaction per arch or one per quadrant. The main advantage of this system is the presence of a rigid wire as an anchor unit and a flexible wire to deliver the eruptive force to the impacted tooth. In DW's case however, the anchorage unit was smaller than the reactive units. To increase anchorage, lingual arches could have been employed, but were not due to patient preference. Due to the geometry and number of impactions, the impacted tooth closest to the anchorage unit received the most eruptive force. As a result, the second premolar and canine in the maxilla received greater eruptive forces than the first premolar.

Continuous nickel titanium wires are extremely flexible and can deliver an almost continuous eruptive force.[29,30] While this property is ideal for eruption of the impacted teeth, it does not provide the necessary rigidity for the anchorage unit. Should one of the impacted teeth be ankylosed (or become ankylosed during guided eruption), the flexible arch wire would not have been strong enough to resist the undesirable side effects. With ankylosis, even full size arch wires with lingual arches may not be strong enough, and significant occlusal plane canting can occur. While the larger arch wire dimension does not remove an undesirable force system, it does make it more difficult for the side effects to manifest.

Vertical interarch elastics from an impacted maxillary tooth to an impacted mandibular tooth can work extremely well with good patient compliance. The patient may forget to wear the elastic, may wear the elastic in the wrong direction, or may not accurately report how much time is spent with the elastic in place. With compliant and knowledgeable patients this system can be particularly effective because they can be informed that the amount of movement is directly proportional to the amount of time the elastic is worn. The patient can develop a sense of ownership and play an active role in treatment.

Finally, auxiliary cantilevers[31–33] can be extremely useful in the guided eruption of a single impacted tooth. One practical limitation is the number of attachments available. To provide sufficient anchorage, one tube (the main arch wire tube), is required for a continuous arch wire. The auxiliary tube can then be used to apply an eruptive cantilever to one of the impacted teeth. However in DW's case, six teeth in the maxillary arch were impacted. It would not be possible to place six cantilevers in the patient's mouth. If all the impacted teeth had been impacted at a similar height, one possible treatment would have included open eruption to place a rigid segment to the group of three impacted teeth. Then, one single eruptive cantilever from the molar to the center of resistance of the impacted segment could have been fabricated, activated, and observed. Due to the geometry and number of impactions, this was not possible.

Utilizing a combination of the first four methods allowed the patient to be involved at times when compliance was high. It also enabled delivery of the necessary eruptive component when the patient was no longer as active a participant. In the future, temporary anchorage devices may be employed to facilitate guided eruption. While the adverse biomechanical side effects are still present, they are transmitted to the temporary anchorage device, and potentially negative side effects on the dentition should be reduced. This should improve treatment results and decrease treatment time.

CONCLUSIONS

Whenever possible, conditions that may affect orthodontic treatment should be confirmed. If confirmation is not possible, a decision regarding whether to provide treatment without this knowledge is appropriate. With or without confirmation of coexisting conditions a candid conservation with the patient about the management plan is necessary before treatment begins. Decisions regarding management of the impacted teeth are always secondary to the underlying medical diagnosis. These decisions include whether open or closed eruption will be used and what method will be chosen to deliver the eruptive force. Class I molar and canine relationships were achieved for this patient, far beyond what was initially deemed possible.

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