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Decision Making on Tooth Extraction in Orthodontics

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INTRODUCTION

The options of extraction versus nonextraction therapy in orthodontics has remained as a controversial topic for a long time. In the early 20th century, Angle favored non-extraction orthodontic treatment and believed that an intact dentition was essential to achieve an ideal esthetics and stability. However, Tweed, one of Angle’s student, noted that many of his cases relapsed especially those with proclined lower incisors. He had to retreat the patients by tooth extraction of four premolars to achieve better functional and aesthetic outcome. Since then, premolar extraction was adopted as treatment strategy to correct the malocclusion in the late 20th century. Currently, with the development of miniscrews and the changes in concept of facial attractiveness, the rate of tooth extraction for orthodontics has declined. It is necessary to completely evaluate the individual patient’s dental, facial and skeletal patterns to offer a correct diagnosis and proper treatment plan.
CASE REPORT

This boy who was referred for orthodontic consultation due to bilateral posterior cross-bite and dental crowding in the upper arch when he was 13 years old (Figure 1). Our treatment plan was conducted by non-extraction with Hyrax expander to expand maxilla at that time. Then alignment the teeth was achieved in the first orthodontic treatment. In the post-treatment panoramic X-ray, we noticed there is supernumerary tooth under tooth 45 and the presence of the tooth germs of all four third molars (Figure 2, 3). After 2-year follow-up, the root development of the supernumerary tooth was evident. Also tooth 28 was more mesially erupted, overlapped with the distal root of the tooth 27. Surgical removal of 28 was suggested; but the patient preferred to follow the tooth instead (Figure 4). Until 2014, he came to our clinic again for periodic observation. The panoramic film demonstrated impaction of tooth 18, 28, 38, 48 and severe root resorption of tooth 27, 37, 46 and 47. Moreover, drift of the supernumerary tooth and causing the 46 severe mesial root resorptions (Figure 5). The cone-beam computed tomography (CBCT) scan revealed that 46 mesiobuccal and mesiolingual root resorption to the level of furcation, more than half length of 47 and 37 distal roots were resorbed, palatal root of 27 was completely resorbed and the distobuccal root was reduced in half length (Figure 6).

Figure 1. Initial intraoral photograph.
**Figure 2.** Completion of the first orthodontic treatment.

**Figure 3.** Panoramic film at the completion of the first orthodontic treatment.
Figure 4. Follow-up panoramic film, 2 year after completion of the first orthodontic treatment.

Figure 5. Follow-up panoramic film, 5 year after completion of the first orthodontic treatment.

Figure 6. The CBCT indicated the external root resorption of 27, 38, 46 and 48.
Treatment objectives

Because the patient didn’t have the problem of space discrepancy in the anterior region nor protrusive lip profile. Functionally, the posterior cross-bite did not cause his difficulties in chewing. Additionally, he had finished the first orthodontic treatment few years ago. He only wanted to have optimal orthodontic treatment. Thus, the treatment objective was only to upright the lower third molars and close the space.

Treatment plan

After discussing with the patient and his parents, the treatment plan was as followings:

(1) Endodontic treatment of 46

(2) Tooth extraction of 18, 27, 37, 47 and the supernumerary premolar

(3) Lingual holding arch with traction hook to protract and upright third molars

(4) Wrap-around retainers

Treatment progress and results

Before the surgical removal of 18, 27, 37, 47 and the supernumerary tooth, the patient had 46 root canal treatment. After the surgical removal of the aforementioned teeth, 6 months was waited for spontaneous eruption of the third molar. The mesial inclination of tooth 38 48 was noted. Lingual holding arch was fabricated with a 0.032-inch stainless steel wire, protraction hooks was soldered to the bands on bilateral mandibular first molars. Lower third molars were bonded with brackets and lingual buttons on the exposed cusps. Elastomeric chains were used to protract and extrude 38, 48 (Figure 7). Sectional wires with 0.018-inch stainless steel L-loop were inserted in both sides of lower arch (Figure 8). The 0.017x0.025-inch TMA wires were used to upright molars sequentially. 38 48 were well uprighted after ten months. After finishing and detailing was completed, the removable wraparound retainer was delivered to patient at debond. The total treatment duration was 14 months (Figure 9, 10).
Figure 8. Sectional 0.018-inch stainless steel archwires with L-loop in both sides.

Figure 9. Panoramic film at the completion of the orthodontic treatment.

Figure 10. Photographs at the completion of the orthodontic treatment.
DISCUSSION

Extraction or non-extraction is the most common dilemma that we encounter in our practice, especially for the borderline case. It is essential to examine the case thoroughly to establish an effective treatment plan. To discuss the extraction or not, there are many factors to be considered. Ruellas et al listed seven factors to evaluate the proper decision of tooth extraction as followsings.

1. Compliance: Sometimes we need additional compliance to achieve treatment success. For example, the treatment options in growing patient with skeletal Class II may include headgears and functional appliances. Nowadays, with the aid of miniscrews, similar treatment outcomes can be achieved whether conducted with or without tooth extractions in some borderline cases. Otherwise, lack of compliance can lead to revise the plan to extractions.

2. Tooth-arch discrepancy: Proffit and Fields reported that in less than 4 mm arch length discrepancy, tooth extraction is rarely indicated, except in cases with incisor protrusion or vertical discrepancy. Small negative discrepancies can be treated without extractions by interproximal dental stripping, uprighting the lower posterior teeth and arch expansions. Arch length discrepancy of 5 to 9 mm allow treatment to be performed with or without extractions, depending on the hard and soft tissue characteristics of the patient and how the final position of the incisors will be moved. For arch length discrepancy of 10 mm or more, extraction is commonly required.

3. Cephalometric discrepancy and facial profile: In situations of pronounced proclination of the incisors and convex profile, extractions are often required to improve the patient’s lip profile by tooth extraction. Currently, we put more emphasis on soft tissue profile rather cephalometric measurements. Therefore, we should bear in mind not worsen the soft tissue profile in order to retract the teeth to match the cephalometric norm values.

4. Growth and anteroposterior relationships: Pubertal growth spurt usually starts between the age of 10 to 12 in girls, and 12 to 14 in boys, subject to individual variations. The cervical vertebral maturation method or hand-wrist radiograph could be used to predict the growth stage. If a patient still has growth potential, we may correct the skeletal discrepancy without extraction. While in adult patients, dental extraction plans would be considered for camouflage the skeletal discrepancy, or orthognathic surgery for correction of the jaw relation.

5. Dental asymmetry: Lewis listed 5 common causes of midline deviations. With proper diagnosis, some cases can be treated with asymmetric mechanics to correct the deviation. Patients with severe dental midline deviation relative to the face may require asymmetric extractions. Small asymmetries can be corrected with intermaxillary elastics, miniscrews or interdental stripping.

6. Facial pattern: Patients with different facial patterns response to orthodontic treatment differently. For dolichofacial patients, distal tooth movement should be planned with cautious by not to wedge the mandible and open the bite. On the other hand, for brachyfacial patients, tooth extractions tend to deepen the bite during the space closure. Although patients with hyperdivergent facial pattern usually show greater anchorage loss than those with hypodivergent pattern; this is not always true. In general, we like to treat high angle cases with extraction of posterior teeth, followed by loss of anchorage to correct the increased lower facial height with resultant counterclockwise rotation of the mandible. However, Kim et al has questioned the effect of wedge effect concept. The biomechanics of space closure with different facial pattern should be considered in treatment.

7. Pathologies: Some pathologies play a key role in determine orthodontic treatment plan. The advanced periodontal problems, ectopic eruption, deep caries
or endodontic lesions may indicate for tooth extraction. When extraction is planned, the tooth with pathology could be a viable extraction alternative for the premolar.

In this case report we may observe the treatment outcome is not satisfy to all. The extraction of first molar rather than the supernumerary premolar could also be an option for extraction. In the light of seven extraction diagnostic elements mentioned above, pathology is the key element in deciding which teeth to extract in our case. If tooth extraction of 27, 37, 46 and 47 were planned for the root resorption, the patient would have no occlusion at right side for a period of time since 46, 47 were missing. We might need to tract the supernumerary premolar prior to upright the bilateral lower third molars. After discussing with the parents of the patient, minimal intervention of current occlusion was decided. Thus, extraction supernumerary premolar rather than 46 was finally decided. Despite the fact that we chose to keep 46, the periodontal findings were normal without tooth mobility after completion of treatment. Whether a complete functioning dentition will persist with age is unknown. With precaution, the patient was encouraged to keep good oral hygiene. Kalkwarf et al pointed out that the prognosis of apical resorption of the root would be better than the peridontal destruction with the loss of alveolar bone support.

We didn't aware of the supernumerary premolar until 2-year follow-up; the root development of the supernumerary tooth was evident. Although we suggested to remove the supernumerary premolar, but the patient favored to monitor the progress instead. He lost follow-up and came back to the clinic three years later. Significant root resorption of 27, 37, 46, 47 were noted.

Rubenstein and Lindauer et al reported that the supernumerary premolars may not become radiographically visible until well after the patient’s normal premolars have erupted. In addition, the patient recalled that he had mesioden removal when he was 8 years of age. Solares and Romero reported that patients with a previous history of supernumerary teeth in the anterior region may have a 24% possibility of developing supernumerary premolars at a later stage. Therefore, it is important to have panoramic radiograph taken periodically follow up in long term to detect the formation of other supernumerary tooth later in dental development. If the supernumerary tooth does not cause any complications to adjacent tooth or structure, yearly monitor with radiographic examination is required. The patient should be informed of possible complication of cystic change and migration to damage the nearby roots.

Nemcovsky et al observed the effect of nonerupted third molars on distal roots and supporting structures and reported that the apical position and mesial inclination of 60° or more of the impacted third molars may be the factors associated with root resorption in the proximal second molars. However, using the orthopantomography or periapical film to locate the tooth position would be misled by overlap of the objects. With the use of CBCT, the external root resorption could be explored more accurately. It is advised to take 3D image when there is a close relation of impacted tooth with normal tooth root seeing in 2D image.

CONCLUSION

1. Decision of orthodontic tooth extraction should not only rely on space discrepancy but also for other aspects, such as facial aesthetics and stability.
2. External root resorption of the second molar caused by impacted molar could be avoided with preventive extraction. With the use of CBCT, better evaluation makes the correct decision. Treatment varies according to the severity of resorption. When a permanent molar demonstrates severe root resorption, an impacted third molar can effectively substitute the tooth by mesially movement with an appropriate orthodontic approach.
3. When a supernumerary premolar develops at a later stage, periodic panoramic radiograph should be monitored for any pathological change. If the patient had previous history of supernumerary tooth in the anterior region, there would be a 24% possibility to develop another supernumerary premolar at later stage.

REFERENCE


