

A Review on Orthodontic Extractions

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Abstract

The role of extractions in orthodontics has been a controversial subject for over a century. In the early twentieth century, Angle favored non-extraction orthodontic treatment believing that all teeth could be accommodated in the jaws in ideal occlusion with first molars in Class I occlusion. This was criticized by Calvin Case who believed extractions were necessary to relieve crowding and aid stability of treatment. Tweed, one of Angle's brightest disciples faithfully followed his master's recommendation to perform treatment without extractions but soon noted that many of his cases relapsed. Tweed in the United States and Raymond Begg in Australia reintroduced extraction into orthodontics in the 1940s and 1950s to enhance facial esthetics and achieve better stability of the occlusal relationships. This led to changes in the goals of orthodontic treatment, which now focus on facial proportions and the impact of the dentition on facial appearance. The soft tissue paradigm states that both the goals and limitations of orthodontic treatment are determined by the soft tissues of the face, not by the teeth and bones, and orthodontic extractions may be necessary to bring about the desired results of the orthodontic treatment. This article reviews recent take on controversies of orthodontic extractions.

Keywords: Orthodontic extraction, Orthodontic treatment, Extraction pattern.

INTRODUCTION AND HISTORY

The main goal of orthodontic treatment is to obtain a normal relationship of the teeth with facial structures. There are many factors that enforce extraction of teeth for orthodontic treatment which can be increased tooth size in relation to the arch size (crowding), supernumeraries, carious teeth, increased overjet, open bite cases, impacted teeth, camouflage orthodontic treatment, malformed teeth, periodontally compromised teeth, orthognathic surgery, etc.^[1]

Angle emphasized that the preservation of all dental units was necessary to achieve facial balance.^[2] But this concept did not go unchallenged. Calvin Case argued that even if the arches were expanded to bring all the teeth into alignment, the stability and aesthetics would not be satisfactory. In 1911, at a meeting of the National Dental Association, Calvin Case presented an article, "The Question of Extraction in Orthodontia," in which he strongly disapproved the creationist belief of the angle school.^[3]

In the 1930s, relapse after non-extraction treatment was frequently observed. Extractions in orthodontics were reintroduced scientifically in the 1930s and with the advent of Begg's technique reaching its peak in the 1960s. He also developed a technique that relied on extractions to create much of the anchorage needed for treatment also became

disappointed in the results he was achieving and decided to re-treat a number of patients who had suffered relapse following orthodontic treatment (at no further cost) using extraction of four premolar units. In such cases, he re-treated patients by extracting four premolars, thereby achieving better functional and aesthetic results.

FACTORS AFFECTING THE DECISION TO EXTRACT

Nasolabial angle

A major motivation for seeking orthodontic treatment is a desire to improve dental and facial esthetics.^[4] The nasolabial angle is formed by two lines one from the nose another from the upper lip and both are independent of each other. Therefore, it is important to analyze each component of this angle to assist in the differential diagnosis of normal from its variation. The measurement of this angle alone provides inadequate information as it does not reveal which component is responsible for the variability.

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Ease of extraction, and the presence of impacted teeth

If teeth are impacted or ectopically positioned, extraction of an erupted tooth can guide the path of eruption of the impacted tooth and obviate the need for minor oral surgery. For example, the impaction of a lower second premolar may be relieved by the removal of the first premolar or first molar, which only requires local analgesia and is less traumatic than the removal of the impacted tooth. If unerupted permanent canines are palatally positioned judicious removal of the deciduous canines can improve the path of eruption of the permanent teeth and may help to avoid lengthy orthodontic treatment.^[5]

Correction of overbite

In some malocclusions, where the anterior face height is reduced, extractions can make space closure difficult and great care must be taken in diagnosis before this decision is made. It is important to recognize whether a case is genuinely crowded or whether the teeth are displaced lingually as in a Class II Division 2 case. Proclination of the lower labial segment also reduces the overbite, as well as overjet, and may obviate the need for extractions. However, this treatment approach should be undertaken cautiously as uncontrolled and excessive proclination of the lower incisors can be unstable and should only be undertaken in selected cases by experienced clinicians. Flattening of an accentuated Curve of Spee in order to reduce an overbite, where proclination is contraindicated, does require

space, for which the extraction of lower teeth can sometimes be considered.^[6]

Tooth-arch discrepancy

Discrepancy between tooth size and arch length is known as the primary cause of malocclusion. Small negative discrepancies can, in most cases, be treated without extractions. Thus, space can be obtained by using leeway space stripping, correction of pronounced mesial tipping of lower posterior teeth, and small expansions and/or protrusions with the goal of restoring normal tipping to the lower teeth, especially if accompanied by rapid maxillary expansion.^[7]

Zero or positive model discrepancies require that treatment be performed without extractions unless the patient has some other associated problem that indicates extraction. Profit and Fields developed a guide of contemporary procedures for evaluating extraction in Class I cases with crowding and/or protrusion. The authors reported that in negative lower arch discrepancies below 4 mm tooth extraction is rarely required, except in cases of incisor protrusion or posterior vertical discrepancy. Negative discrepancies in the lower arch between 5 mm and 9 mm allow treatment to be performed with or without extractions, depending on the characteristics of the patient and the orthodontic mechanotherapy that was used. Finally, for negative discrepancies of more than 10 mm extraction is almost always required, preferably of first premolars because second premolar extraction is not suitable for large discrepancies.^[8]

Cephalometric diagnosis (CD) and facial profile

In situations of pronounced labial tipping of the incisors with a high CD and expressive facial convexity, extractions are often necessary to retract these incisors, improving the patient's profile Figure 1. Sometimes a case is finished with protrusive incisors so as not to alter a satisfactory profile, whereas one can resort to stripping to create spaces that would allow these teeth to be slightly uprighted.^[9]

Skeletal age (growth) and antero-posterior relationships

It is possible to correct a skeletal dysplasia with the use of appliances that produce orthopedic effects. If a malocclusion can be corrected with growth response (growth redirection), clinicians can handle the case without extractions.^[10]

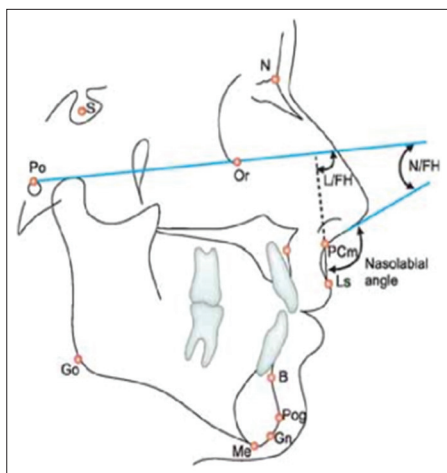


Figure 1: Nasolabial angle in cephalometric tracing



Figure 2: Extra-oral photographs

Dental asymmetry

According to Strang, the harmonic positioning of the midline relative to each other and to the face is what characterizes normal occlusion, and any variation in this combination is indicative of improper relationship between the teeth or dental arches Figure 2. This requires a careful diagnosis because properly assessing the causes behind midline shifts allows professionals to use unique mechanics and asymmetric extractions.^[11]

Patients presenting with severe dental midline deviation relative to the face (especially in the lower arch) require tooth extractions. Small asymmetries can be corrected with intermaxillary elastics or mini-implants, asymmetric extractions, stripping, and in a few situations, orthodontists will have to settle for completing orthodontic treatment with a little midline deviation. Patients with different facial patterns require different mechanics, and responses to orthodontic treatment are not similar.

Pathologies

Some pathologies play a key role in defining orthodontic treatment planning. Patients can have half-formed teeth, agenesis, ectopic, abnormal shapes or even carious processes, and endodontic lesions that indicate tooth extraction.

In patients with an indication for premolar extraction due to a sharp negative model discrepancy, but either extensive decay in the first permanent molars, these teeth are a variable extraction alternative for the premolars. In asymmetric malocclusions, where only one tooth must be extracted, if the patient happens to have an anomalous tooth, this tooth should be selected for extraction. Many other pathological conditions such as cysts, abnormal roots, and periodontal problems indicate the extraction of teeth. Thus, the different pathologies greatly contribute to orthodontic treatments involving extraction.^[12]

EVALUATION OF DIAGNOSTIC AIDS FOR EXTRACTION

Photographs

A full set of clinical photographs, if taken to a high standard, is an invaluable record detailing the original clinical situation before any treatment has started. These should be a mandatory record for each and every patient we diagnose and treatment plan if the treatment is only extraction of teeth to intercept or simplify the developing malocclusion.

Model analysis

A study cast analysis is a three-dimensional assessment of the maxillary and mandibular dental arches and the occlusal relationships. Too often, model analysis is not correlated with other important diagnostic criteria, i.e. cephalograms and panoramic radiographs.^[13]

Lateral cephalometric head film

The radiograph enables the orthodontist to determine craniofacial and dentofacial relationships as well as soft tissue relationships.^[14]

Cephalometric analysis

Cephalometrics provides information about the maxillary relationship to the cranial base, the mandible's relationship to the

cranial base, the maxilla's relationship to the mandible, vertical skeletal relationships, lip protrusion, vertical facial proportions, and the position of the teeth to the underlying jaws.^[15-17]

EXTRACTION PLANNING IN DIFFERENT MALOCCLUSION

Class I malocclusion

Treatment of class I with crowding has several different modalities: interproximal reduction (stripping), expansion, derotation, uprighting, distalization, and extraction. Table 1 simplifies and briefs the options of extraction for general dentist, orthodontic residents, and specialists. Extraction of all first premolars is usually indicated in moderate-to-severe crowding in the labial segment to create space for relieving of crowding. In case one of the second premolars is carious, consider leaving the neighboring first premolar with anchorage enforcement. Extraction of all second premolars is usually indicated in grossly carious, largely filled, or periodontally compromised second premolars and first premolars in good condition; moderate crowding in the labial segment and a degree of crowding in the posterior region; anterior open bite, as extraction of the second premolar helps in deepening the bite and for centreline correction. It is preferred over first premolar extraction if the facial profile is wanted to remain unchanged.^[18]

In case one of the first premolars is carious, consider leaving the neighboring second premolar. First permanent molars are extracted in case of poor prognosis, such as the presence of large restorations. Extraction of all second permanent molars is indicated in relieving of possible impaction of the second premolar due to mesial drift of the first molar. Extraction of lower second premolars in case of hypodontia of upper lateral incisors.^[19]

Table 1: Patterns of extraction for class I malocclusion

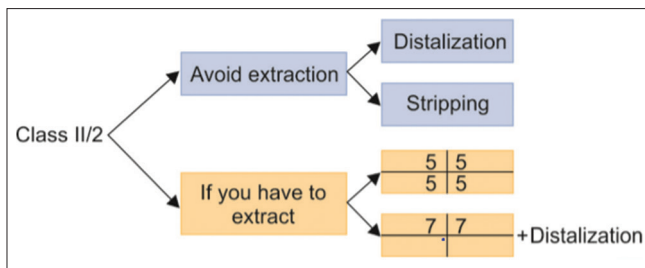
Class I	Patterns															
	1	2	3	4	5	6	7									
	4	4	5	5	6	6	7	7	4	5	4	6	5	6	2	2
	4	4	5	5	6	6	7	7	4	5	4	6	5	6	5	1

Table 2: Patterns of extraction for class II division 1 malocclusion

Class II/1	Patterns													
	1	2	3	4	5	6								
	4	4	4	4	4	4	6	6	7	7	2	2	2	2
	4	4	5	5									5	5

Table 3: Patterns of extraction for class III malocclusion

Class III	Patterns													
	1	2	3	4	5	6								
	5	5		4	4	6	6	5	4	5	6	4	4	
	4	4	1	4	4	6	6	4	4	4	6	5	5	



Flow Chart 1: Patterns of extraction for class II division 2 malocclusion



Figure 3: Intra-oral photograph

Class II division 1 malocclusion

Treatment of class II has several different modalities: Growth modification, orthodontic camouflage, surgical correction. Table 2 presents class II division 1 to simplify and brief the options of extraction in class II division 1 Figure 3. Extraction of first premolars is considered to be one of the most commonly extracted teeth in orthodontics around 59%, followed by second premolars 13% and permanent molars 19% (1st permanent molars 12% and 2nd permanent molars 7%). Only 1% extracted permanent incisors.^[20]

Extraction of maxillary first premolars and mandibular second premolars is usually the extraction of choice in the management of increased overjet associated with a class I or mild class II skeletal pattern with moderately crowded arches.^[21]

When treating class II in the absence of crowding with the extraction of upper first premolars, the anterior segment of the upper arch is distalize to the extent of a premolar width (7 mm) so that cuspids can establish a class I relationship, while molars correct to class II full unit.^[22]

Removal of second permanent molars for correction of class II division 1 is suggested in case of excessive buccal inclination of the incisors, no diastema, minimal overjet, presence of conveniently positioned and shaped third molars, patients with a dolichocephalic facial pattern, a tendency toward vertical growth, and the need for first permanent molar retraction.^[23]

Class II division 2 malocclusion

Extraction of upper and lower second premolars is preferred to first premolars in cases of severe crowding to prevent the excessive movement of the lower incisors lingually, which leads to deepening of the bite.^[23]

Class II subdivision malocclusion

Conventionally, four premolars are extracted in such cases to achieve a bilateral Class I molar relation which needs patient compliance with the use of Class II elastics. On the other hand, asymmetric extraction of three premolars will produce Class I canine and molar relationships on the Class I side and Class II molar and Class I canine relationships on the Class II side, along with coincidence of the maxillary and mandibular dental midlines.

Class III malocclusion

The extraction of choice for camouflage is the extraction of lower first premolars and upper second premolars. The second pattern is to extract one central incisor either right or left. It is the tooth of choice in situations where crowding is not large. Extraction of all first premolar is carried out sometimes in severe crowding or in cases of class III complicated with anterior open bite. In cases where the one side is a class I and the other is class III, extraction of either first premolar/first permanent molars on the class I side, and extraction of first lower premolar and upper second premolar is advocated to correct the anterior and posterior occlusion to finish in a class I incisor, canine, and molar relationship Table 3.^[10,24]

TYPES OF EXTRACTION IN ORTHODONTICS

Balancing extractions

The removal of a tooth on the opposite side of the same arch in order to preserve symmetry.^[25]

Compensating extractions

Removal of the equivalent tooth in the opposing arch to maintain buccal occlusion.

Enforced extractions

These extractions are carried out because they are necessary as in the case of grossly decayed teeth, poor periodontal status, fractured tooth, impacted tooth, etc.^[25]

Therapeutic extraction

Certain sound healthy teeth may have to be sacrificed to facilitate proper alignment of other teeth in cases of severe arch length-tooth material discrepancy.

Wilkinson extraction

Wilkinson advocated extraction of entire first molars between the age of 8.5 years and 9.5 years, as this:

- Prevents impaction of third molars.
- It relieves crowding in the dental arch.
- It helps in decreasing the incidence and occurrence of dental caries.^[25]

Serial extraction

Serial extraction was first advocated in 1948 by Kjellgren, as a solution to a shortage of orthodontists. This treatment technique involves the sequential removal of deciduous teeth to facilitate the unimpeded eruption of the permanent teeth.^[26]

CONCLUSION

An attractive balanced smile is a prime objective of modern orthodontic therapy. This topic has gained importance for clinicians as orthodontic patients evaluate the outcome of their treatment not only through occlusal harmony but also through their smiles and the enhancement in facial appearance at the end of treatment.

A Borderline case may be treated by either extraction or non-extraction methods. Dichotomy exists with these cases. Therefore; precise treatment planning is a must for borderline cases to provide the best possible aesthetics and stability of the results to the individual. Careful management of the residual extraction space preserves normal lip support and facial profile.

Identifying guidelines for the extraction v/s non-extraction decision in orthodontic treatment is a complex task. The option to treat with extraction or non-extraction should be made objectively for each case based on strong evidence with equal attention on the soft tissue paradigm.

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