



## **Treatment Decisions for Borderline Cases: A Review**

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### **ABSTRACT**

*Orthodontics is a speciality of dentistry that deals with treatment of mal-aligned and mal-positioned teeth. Crowding is considered more to be a malocclusion as compared to spacing in a layman's perspective. Space is required for the treatment of a crowded arch and this can be obtained via two treatment modalities i.e., via extraction or non-extraction therapy that obligates employment of either extraction of certain teeth for gaining space or adapting some other methods to gain the required space. These approaches of either going for extraction or non- extraction are a highly controversial issue in contemporary treatment planning especially in borderline cases because of the advantages and disadvantages of both the methods in the long run.*

**Keywords:** *Borderline cases, Extraction Vs Non-extraction, Controversy, arch-length discrepancy, non-extraction alternatives*

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### **INTRODUCTION**

Facial appearance is one of the major reasons why an individual seeks for orthodontic treatment. Also, a patient's profile is examined for the insight of ideal facial beauty in the orthodontic literature. Extraction or non-extraction treatment modality; both have remarkable variance in the outcome of treatment on the facial profile of an individual but which modality is better than the other especially when we talk about the borderline cases is still a topic of conflict.

A borderline case is the one which is arrested between the two different treatment modalities i.e., extraction and non-extraction. Different expert orthodontists might have different definitive treatment plans for a single borderline case when given the chance to examine independently. The different problems in a borderline case must be divided into its etiological causes such as Borderline orthopaedic problems of skeletal discrepancy, Orthodontic problems of arch length-tooth material disharmony, poor alignment caused by localized migrated teeth and combination of all the above [1].

The decision to extract or not is still a debatable issue which started in early 20<sup>th</sup> century by Dr. Angle who favoured the use of non- extraction treatment modality in all patients. He believed that in an ideal occlusion, all the 32 teeth could be accommodated in the jaws with the first molars in a Class I molar relation [2]. This was criticized in 1911, by Dr. Calvin Case who was in favour of extraction modality in orthodontic practice as he felt extractions were primarily required for relieving crowding and later on stability of the treated case. Later, Dr. Martin Dewey ridiculed Case for using "evolution" during the debate to secure his faith and Dewey's belief won the debate. Thereafter, extraction modality was abandoned.

But later, Tweed was let down by the outcome he was attaining by non-extraction modality and he choose to re-treat a number of patients whose orthodontic treatment was relapsed using extraction of four

premolars. The illustration of his results led to change of the non- extraction philosophy to extraction modality in 1940s [3].

Recently, the debate on extraction has restarted, with some orthodontists believing that jaw expansion and posture retraining can eliminate extractions with promising results [4].

In borderline cases, extractions are necessary to fulfill various treatment goals that include relieving of dental crowding, decreasing protrusion of labial dentoalveolar segment and overlying soft tissue, for improving lip competency and for doing dental camouflage of underlying skeletal disharmony<sup>4</sup>. When performed after a sufficient diagnostic evaluation, extractions have no negative impact on the finished occlusion, stability, soft tissue profile growth pattern or smile aesthetics [5].

Clinicians must also not overlook the possible negative aspects associated with both the approaches. If extraction treatment therapy is opted without proper planning, it may have undesirable effects on the soft tissue profile and decreased inter-premolar width leaving visible buccal corridors [6]. Whereas, when non-extraction modality is opted to treat a significant dentoalveolar discrepancy, the likely complexity may be extreme teeth flaring resulting in gingival recession due to loss of alveolar bone [7].

CONTEMPORARY EXTRACTION GUIDELINES (According to Proffit) [8]:

- <4 mm arch length discrepancy- rare indication of extraction
- 5-9 mm arch length discrepancy- borderline case
- >10 mm arch length discrepancy- need for extraction is almost always so as to gain space.

FACTORS TO BE CONSIDERED FOR EXTRACTION AND NON-EXTRACTION TREATMENT DECISIONS IN BORDERLINE CASES:

#### I. DENTAL FACTORS:

- Dental asymmetry: Patients exhibiting severe dental midline deviations i.r.t. the face (especially in the lower arch) possess the need for asymmetric teeth extractions. Whereas, smaller asymmetries do not need extractions and can be fixed with the use of TADs or simply by intermaxillary elastics, or via inter proximal reduction.
- Pathologies: Patients can have agenesis, ectopic eruption of teeth, abnormal shapes, caries or endodontic lesions that require tooth extraction. These pathologies must be taken in consideration during diagnosis as they may decide or even change the teeth or tooth to be extracted many times.
- Facial Profile: The decision of extraction of teeth for orthodontic treatment usually effects patient's profile. Currently there is a drift of focus from cephalometric measures to facial features in orthodontic diagnosis and treatment planning. In accordance with Ramos et al, for each one mm of upper incisor retraction there is 0.75 mm upper lip retraction. As per as the lower lips are concerned, there is 0.6 mm or 0.78 mm retraction for 1mm of lower incisor retraction [9]. Thus, the profile becomes more concave when space closure is done by anterior teeth retraction.
- Tooth Size Arch Length Discrepancy: Tooth size arch length discrepancy must be assessed in maxillary and mandibular arches. However, mandibular arch is the priority for diagnostic purposes because of the greater difficulty in obtaining space in the particular arch. A significant negative tooth size arch length discrepancy in the mandibular arch require tooth extractions during the orthodontic treatment. However, there is no need of extraction for small negative discrepancies.
- Curve Of Spee: 3-6mm (1.5-3mm/side) of curve of spee is considered to be mild [10] whereas, more than 6mm of curve of spee is severe [11]. The chances for an arch length deficiency increases with exaggerated curve of spee and thus extraction can be the decision to gain space if the discrepancy is more [11-14].
- Bolton's discrepancy: Bolton recorded that a discrepancy of upto 4 mm can be treated without extraction [15]. Discrepancy of more than 4mm require extraction to adjust the inter arch dental relationship.
- Peck and Peck: The ideal range of Peck and Peck index is 88-95. Values more than 95 indicate excessive mesio-distal width of teeth in comparison to the buccolingual width and IPR can be done to reduce the tooth material in most cases, whereas index smaller than 88 indicates contraindication of IPR [16].
- Irregularity Index: Irregularity index of >6.5mm demonstrate severe irregularity and the need for extraction in borderline cases.

#### II. CEPHALOMETRIC COMPONENTS [17]:

- IMPA: The normal range of IMPA according to Tweed is 85 degree-95 degree. An IMPA greater 96 degree indicates need for extraction.
- FMIA: The normal range of FMIA is 60 degree -70 degree. Values <60 degree indicates proclination of mandibular incisors and indicates need for extraction.

- Distance between LI and A-Pog line: A good sagittal position of mandibular incisors and A- Pog line is indicated by values between -2mm and 3mm. Values >3mm generally requires need for extraction.

### III. SOFT TISSUE FACTORS:

- Nasolabial angle: The range of an ideal nasolabial angle lies between 90° to 95° for males and 95–115° for females as reported by literature. However, these values may vary among different races [18]. Therefore, in borderline cases, extractions can be performed in acute Nasolabial angle cases and should be avoided in obtuse nasolabial angle cases.
- Upper and lower lip position: A borderline case presenting lip protrusion before treatment may be treated nicely with extraction. Likewise, patients with retrusive profile can be treated with non-extraction modality to get a better profile. [19]
- Lip prominence: In accordance to Arnett and Bergman, extraction should be avoided in patients with flaccid lips because of lack of labial support. [20]

### IV. GROWTH :The decision of extraction in borderline cases having significant residual growth potential should be considered cautiously. Whereas, the extraction decision is safer to adopt in adult orthodontic borderline cases.

### NON- EXTRACTION ALTERNATIVES FOR TREATMENT OF BORDERLINE CASES:

- *ARS*: Air-rotor stripping can be used to remove a specific amount of enamel (interproximally) to make space, for aligning or retraction of teeth. ARS can resolve arch length- tooth material discrepancies, and can be adapted as an alternative to extraction in selected cases.
- *Expansion*: Expansion was a common method used to relieve posterior cross bite. It gained popularity in 1988, when this method was started to be used as an alternative to extraction in borderline cases. Crowding in borderline cases can also be resolved by rapid palatal expansion (RPE) in patients with narrow transpalatal widths. The amount of crowding relieved by RPE ranges from 3-6mm in the mandible. Although several studies support that the inter-canine width expansion during orthodontic treatment therapy is unstable, there is little evidence that indicate expansion stability, especially in the lower arch. Other prospective adverse effect of expanding an arch is the likelihood of formation of dehiscence as a result of overexpansion.
- *Molar Distalization*: In recent years, the orthodontic extraction percentage has decreased considerably as experiments have shown that extraction of premolars does not guarantee stability of teeth alignment. The amount of space gained by molar distalization is roughly equal to the amount of distal driving of molars. This approach is becoming popular due to the fact that psychological trauma from extraction can be avoided.
- *Leeway Space Preservation*: As stated by Gianelly [21], about 75% of mild-to-moderate crowding in Class I and II cases with can be resolved without expanding the arches or by doing extractions. It can be achieved by preserving the leeway space of the deciduous second molars. A lingual arch can be used to resolve 5mm of incisor region crowding. However, extraction may be the choice of treatment for moderate-to-severe crowding cases exhibiting protrusion and in which the leeway space has been lost.
- *Self Ligating Brackets*: SLB have become very popular these days. The major advantage stated by the promoters of SLB is reduction in friction between the wire and the bracket slot. Therefore, the force required to move teeth is considerably low and it enables increased formation of alveolar bone. Several studies over the last few years have shown that SLB have reduced the extraction frequency for correction of malocclusions with mild to moderate amounts of crowding due to the expansion that can be obtained with self-ligating appliances and high- technology arch wires. Hence, SLB can be used as an alternative to avoid orthodontic teeth extractions.
- *Temporary Anchorage Devices*: Nowadays, the frequency of choosing non-extraction treatment modality has been increasing because of the availability of TADs which has promising efficiency and minimally invasive. Although TPAs, Nance palatal arches and head gears have been extensively used for anchorage augmentation, some amount of anchorage loss, mesial inclination and extrusion of the molars are still common undesirable changes often experienced. Tads provide critical anchorage because the force is directed to the supporting bony structures instead of teeth. Many studies have concluded that maxillary arch expansion [22] and space closure without anchorage loss can be aided with TADs causing a reduction in extraction modality in orthodontics [23,24,25]. Also, the TADs made distalization (molar distalization as well as asen-masse movement of the buccal segments) possible therefore, avoiding the need of extractions for retraction [26].

### WHY IS THE CONTROVERSY:

- *Facial Profile*: The main controversy involved in the borderline cases is the effect on the soft tissue profile with and without extractions. Pioneers in the favour of non-extraction treatment modality

affirm that extractions create a “dish-in” effect on the face, while on the other hand pioneers in the favour of extractions claim that if patients with already “fuller” profiles if treated with non-extraction therapy will have “too-full” and periodontally compromised teeth at the end of the treatment. Many authors in fact also agree to the fact that extraction treatment in patients with “fuller” profile can produce esthetically better and more pleasing facial profiles. Therefore, orthodontists can actually take advantage of extraction therapy for reducing protrusive profiles. One more factor that should not be ignored is that with time the profile tends to straighten no matter what treatment therapy (extraction/non-extraction) is chosen to treat the patient. It is because of the late mandibular growth. The face has a tendency to flatten with ageing. Therefore, orthodontists must consider maturation, soft-tissue growth and aging while making a treatment plan.

- *Buccal Corridors*: Some orthodontists believe that maxillary premolar extraction can cause narrowing of the dental arch resulting in unesthetic narrowing of the buccal corridors [27] but as per literature most of the studies reject this belief [28, 29] and infact, studies also claim that broader buccal corridors are not always unattractive [30, 31].
- *Risk of Impaction and Stability*: Bowman in 1999, highlighted that following non-extraction treatment modality always would not be the best decision for many patients<sup>32</sup>. Patients exhibiting severe crowding or dentoalveolar protrusion will have compromised aesthetic with “fuller” profiles, unstable and periodontally compromised dentition at the end of the treatment. According to many researchers, a general conclusion is drawn that firstly, the extraction of premolars to relieve crowding may not increase the stability and secondly, non-extraction therapy may be responsible for increased frequency of impacted mandibular second-molars.

## CONCLUSION

Various investigations have been conducted on post-treatment soft tissue changes in cases treated with and without extractions. However, no method can be declared better over the other as it varies from case to case. There are many studies that show that there is a greater root resorption observed in maxillary incisors during extraction treatment. However, from the clinical perspective this amount of loss may not be of clinical significance and non-contributory for periodontal health. Historically, health care has historically been doctor-centered, with minimal importance to patient input. However, patients now are more decisive than in the past. They often demand for a “conservative” non-extraction treatment option and a competing orthodontist must be flexible enough to opt for the modality. Hence, both the methods of orthodontic treatment; Extraction and non-extraction can be implicated in daily orthodontic practise. But the treatment modality should be chosen objectively for each patient based on resolute proof with uniform concentration on soft tissue paradigm, some importance to hard tissue paradigm and of course to the patient’s preferences.

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