Review Article

Extraction Vs Non-Extraction / The Debate Continues : A Review

ABSTRACT

The decision to extract teeth for orthodontic treatment is one of the most debated subjects in the history of the specialty. Angle advocated non extraction while case a few years later proposed extraction in selected cases because of the concern for stability. In the 1930s, many practitioners began to observe generalized relapse with nonextraction treatment. Charles H. Tweed Used cephalometric analysis to support the extraction of all four first premolars and initiated a swing among the orthodontic community toward extraction therapy.

The popularity of extraction therapy lasted well into the 1970s. During the 1980s, the pendulum swung back toward nonextraction, and that trend persisted until the end of the milleneum. The resurgence of nonextraction therapy is probably the result of many factors, including the renewed popularity of early intervention, a greater acceptance of functional appliances in the United States, and the change from fully banded appliances to direct-bonded brackets. Finally, a consumer-driven market for treatment without extractions, combined until recently with a conspicuous lack of experimental evidence to support either position, has ultimately kept the extraction-nonextraction debate at the forefront of orthodontic concerns. The last two decades has seen noticeable decline of extraction in orthodontic treatment. This is augmented with increased pressure from the referring dentist to treat the patient without extraction treatment modality, being unaware of the literature supportive of extractions in specific cases. The controversy becomes even greater when dealing with borderline cases. In a respected specialty such as orthodontics, the decision to extract or not should, at least in part, be based on scientific assessments of treatment outcome. This review provides a summary of historical background of the controversy, the perspectives of various authors, the reasons for decline in extractions and the present understanding of the debate.

Keywords: Orthodontic cases, Extraction, Non extraction, Debate, Current view

1. INTRODUCTION

Crowding of teeth constitutes one of the most prominent feature of malocclusion resolution of which generally requires extraction of teeth, especially when it is severe. Decision to extract teeth is particularly difficult in borderline orthodontic cases. Orthodontists with experience tend to prefer the extraction option[1], especially in class II malocclusion, moderate to severe crowding and open-bite problems [2]. Albeit, extraction of teeth directly influences vertical dimension of face, stability of treatment, arch width and perioral soft tissues and subsequently, facial profile in various ways[3,4].On the contrary, minor skeletal and moderate dental discrepancies are easy to deal without extraction of teeth.

2. HISTORICAL PERSPECTIVE

Extraction of Teeth to accommodate remaining teeth in crowded dental arches have been in practice from as early as 1771. Celsus and Pierre Fauchard recommended extraction of deciduous teeth to clear the way for permanent successors. Hunter[5] in 1771 opposed the extraction of permanent teeth with the reasoning that this can cause growth inhibition of face and jaws. In 1907, Edward H. Angle professed that moving teeth into normal occlusion with orthodontic forces would cause the jaws and associated bones to

grow to accommodate the increased size of the dentures [6]. He elaborated this idea through case series and research data in his book titled, “Treatment of Malocclusion of the Teeth and Fractures of the Maxillae-Angle System”. He called his edgewise appliance a “bone growing appliance” and suggested that the movement of teeth directly affects facial profile. He followed in his entire career that best esthetics are achieved with all the teeth aligned in occlusion proposed to preserve all the natural teeth by expanding the dental arches.

Calvin Case[7] however, gave the contrasting arguement that, although most malocclusions could be treated without extractions, the objective of stability cannot be achieved in every case. This war of ideology between Angle and Case arose in 1911 and widely disseminated in the orthodontic community as "The Extraction Debate." Calvin Case presented his viewpoint in the article, "The Question of Extraction in Orthodontia” in a meeting of the National Dental Association in 1911. Rousseau, a philosopher and clinician, also supported the theory of Calvin Case. Wolff’s law of bone by Julius wolff disclosed that stress produced on application of force can lead to alteration of bony trabeculae and thus supported the nonextraction ideology. Nonextraction treatment remained the standard until the 1940s when it was observed that non-extraction treatment frequently ended in relapse. Charles Tweed [8] advocated the extraction of all four first premolars although he was a student of Angle. Using cephalometric analysis to support his position, Tweed initiated a strong motivation in the orthodontic community toward extraction therapy. Raymond Begg [9] in Australia also developed an appliance system based on therapeutic extraction at the same time Tweed was developing his technique. Professor Stockard’s breeding experiments favoured the theory of attritional occlusion on which Begg’s appliance was based. According to these experiments, disparities between tooth size & jaw size could be genetically determined or could be produced by the lack of proximal wear on teeth. Extraction of teeth was suggested to resolve these disparities. But extensive and indiscriminate extractions of premolars for correction of malocclusion frequently resulted in unattractive facial features and therefore orthodontic community subsequently realized the cardinal importance of facial harmony and esthetics thereby reducing the haphazard premolar extractions. Henceforth nonextraction treatment resuscitated in 1970-1990’s. Little et al [10] and Mc Reynolds et al.[11] sustained that stability of tooth alignment was not ensured by premolar extractions. Later introduction of largely bonded appliances made the expansion of arches feasible and convenient, so the border line cases could be treated without extraction of teeth, with better results and less psychological trauma. Paquette et. al.[12] compared the radiographic changes that occurred in a series of borderline cases treated with or without the removal of premolars. They concluded that the profile became 2 mm flatter in patients who were treated with extraction of teeth.

Hence orthodontic extraction was new and not so common in the early 20th century, frequent in the sixties, ignored in nineties, and just persisted in the first few years of the 21st century [13]. The latest trend is to reserve extraction therapy to the selected cases with mild to moderate skeletal discrepancy which can be managed with camouflage therapy avoiding surgery or to the moderate to severe dental discrepancy which could not be managed without extraction of teeth, keeping in mind the indispensable factors of functionality, esthetics and facial profile with careful cephalometric analysis of bone, teeth and soft tissue parameters.

3. REASONS FOR CONTROVERSY

3.1 Facial Profile

The impact of extraction of teeth on the soft tissue profile of the patient is a major concern. Facial profile becomes concave with extractions whereas non-extraction compromises the patient periodontally and makes the profile bulge and become convex. Rushing et al. [14] Stephens et. al. [15] and Erdinc et. al. [16] emphasized that the differences between facial profiles of patients treated with extraction and non-extraction of teeth were imperceptible to general dentists and orthodontists. Solem et al [17] in their 3-D soft-tissue analysis revealed that, patients who had protrusion of teeth showed distinct changes in facial profile following treatment by extraction, and retraction of the upper and lower incisors directly affected the retraction of the lips. They concluded that extraction of teeth does not necessarily cause sunken facial appearance in patients whose profile is already convex because of protrusion of teeth and paradoxically results in better facial esthetics than non-extraction. Nevertheless over-retraction of the anterior teeth definitely leads to undesirable profile changes, specially in patients with straight or concave profiles.

Additionally the profile has the tendency to straighten over-time as the mandible keeps on growing for a longer time than the maxilla throughout adulthood. This can lead to confounding the problem if ignored earlier during treatment. Therefore enough consideration must be given in the treatment planning to the growth of soft tissues, maturation and aging [18,19,20].

Konstantonis et al.[21] performed a meta-analysis on 9 databases which assessed 24 studies and included 1456 patients. They studied the effect of extraction on the soft tissue profile and found a mean difference of 1.96 mm between upper and lower lips. There was more prominent lower lip retraction caused by extraction of teeth. In another database comprising of 1149 patients in 21 studies found a mean difference of 1.26 mm between upper and lower lips and linked upper lip retraction to extraction. Twenty-one studies done in 109 patients disclosed a mean difference of 4.21° in nasolabial angle in context with extraction. Six studies on profile convexity in 408 patients showed a mean difference of 1.24° in the nasolabial angle. The meta-analysis pointed to the fact that although extraction affects the patient profile, yet no specific profile outcome can be expected.

3.2 Buccal Corridors

It was speculated that extraction of maxillary premolars can cause narrowing of the maxilla, resulting in wide buccal corridors. Ioi et al. [22] assessed the effect of buccal corridors on smile esthetics. They modified the buccal corridors digitally in 5% increments, from 0% to 25% and compared with the inner commissural width. 32 Japanese orthodontists and 55 Japanese dental students were involved for rating the six smile patterns acheived. There was no significant difference between the ratings for both genders, however both groups of dentists perceived significant differences in the median esthetic scores. A clinically significant reduction in the median esthetic scores was observed when buccal corridors were enhanced from 10% to 25% for both the genders. Similar results were reported by Meyer et al. [23] who suggested that broader buccal corridors may be attractive and narrow maxillary arches may not necessarily result from extraction of maxillary premolars.

3.3 Temporomandibular Joint Disorders (TMDs)

There was a misconception that Temporomandibular joint problems occur in orthodontic patients treated with extraction of teeth. Gianelly et al. [24] studied 111 patients, out of which 79 patients were treated without extraction and 32 patients with extraction of teeth which included 27 patients with 1 or more premolar extraction and 5 patients with anterior tooth extraction. The study disclosed no significant difference in pretreatment and posttreatment condylar positions. The study also depicted that no movement of condyle occurs during routine orthodontic treatment.

3.4 Loss of Stability

Because of the variation in positioning, tipping, and crowding of teeth in different patients, nonextraction of teeth in every patient may not be able to produce an equillibirium in terms of stability, which may require extraction in some cases to obtain better results as was suggested by Bowman et al.[25] On the other hand, Erdinc et al.[26] conducted a study and proposed that the extraction of premolars to improve crowding may not always augment stability.

3.5 Risk of Impaction

According to Saysel et al.[27] risk of impaction is reduced in orthodontic patients treated with the extraction of premolars as there is more space for the third molar to erupt. Turkuz et al. [28] found that third molar impactions were present in 81% of patients who were treated without premolar extraction, whereas only 63% incidence was found in premolar extraction cases. Cassetta et al. [29] evaluated 40 patients with mandibular second molar impactions and 200 patients without second molar impactions. Characteristic features like significant crowding, a smaller distance between the anterior margin of mandibular ramus and mandibular first molar and higher angle of mandibular second molar inclination; were more significant in patients with second molar impactions.

4. REASONS FOR DECLINE IN EXTRACTIONS

4.1 Expansion

Rapid maxillary expansion (RME) has shown remarkable results in resolving crowding in borderline orthodontic cases i.e. 3–6 mm of crowding with narrow transpalatal widths. It became glorified in the 1980s as an outstanding, sought after treatment to resolving crowding even in cases that lacked posterior crossbite, as a substitute to extraction treatment. Reciprocal mandibular expansion is occurs as mandibular arch form is dictated by maxillary arch form. McNamara Jr. et al [30] reported that Rapid maxillary expansion expedited the process of improvement in the sagittal occlusal relationships between maxillary and mandibular teeth. Many authors support the contention that intercanine expansion is unstable. Housley et al [31] reported that intercanine widths were maintained in only 8% of patients who underwent mandibular expansion and that too just for a short period of six years and three months after fixed retention. Ironically overexpansion can produce prospective complications like risk of creating a dehiscence (loss of alveolar bone on the facial aspect of a tooth that leaves a characteristic oval, root-exposed defect from the cementoenamel junction apically) or labial tipping or displacement of anterior teeth in moderate to severe crowding. Extractions on the contrary, allow the teeth to move along the alveolus.

4.2 Leeway space

In Class I and II malocclusion, mild to moderate crowding can be resolved by the use of Leeway space. Mild crowding can also be relieved by lingual arch in the mixed dentition as was suggested by Sonis et al. [32]. Contemporaneous guidelines about extraction of teeth are following [33](Rubin ,2012)

- <4 mm of arch length discrepancy - extraction is rarely indicated,
- 5–9 mm of arch length discrepancy - posterior extractions may be required
- >10 mm arch length discrepancy - extraction is always required.

4.3 Air-rotor Stripping (ARS)

Dr. Jack Sheridan suggested that approximately 6–8 mm of the space can be gained to rectify protrusion, crowding or a combination of both by ARS or interproximal enameloplasty [34]

4.4 Bonding

Bands occupy space and therefore aggravate crowding and misrepresent the discrepancy.

Bonding of fixed appliances that has largely replaced banding, permits nonextraction treatment in more patients, since space requirement is reduced to accommodate all the teeth.

4.5 Self-Ligating Brackets

Self-ligating brackets have two distinct advantages over conventional brackets : reduced chairside time (insertion and removal of wire is easy) and control of mandibular incisor proclination [35,36]. Since the efficacy of self-ligating brackets is considered better than conventional brackets in terms of arch broadening effect and controlling the inclination of teeth, It reduces the need for extractions in most cases in reference to space requirement..

4.6 Use of temporary anchorage devices (TADs)

Before TADs were introduced in the orthodontic society, extra-oral traction using headgear was in vogue for distalization in the upper jaw, in which patient compliance was critical to the success of the therapy. TADS came with the unprecedented benefit of almost absolute anchorage [37]. Mini implants facilitate three dimensional stable anchorage. Mini screws, of all orthodontic implants, have gained worldwide acceptance due to less invasive surgical procedure and easy installation.

Indications [38] : Missing posterior units which are generally used for anchorage.

1. Complicated movements of teeth e.g. anterior and posterior intrusion and distalisation of teeth.
2. Asymmetrical or unilateral movement of teeth.
3. Non extraction treatment of borderline cases .
4. To manage most difficult and extreme orthodontic cases e.g. enmass distalization of whole upper or lower arch.

4.7 Autonomy

Expansion in the common man's sphere of medical know how and easy accessibility of broad aspects of treatment options on the digital platform of internet has made patients more aware and informed and thus they are more actively involved in their treatment decisions. However Knowledge without practical experience and clinical application also brings about apprehension about some treatments especially which are invasive in nature as is the extraction of teeth in its unique psychological and emotional impact specially in adolescents and young adults, related to the fear of pain and loss of teeth. It has led to narrowing the horizon of doctors' preference of treatment approaches in any particular case. Finally patient's perceptions and desires take precedence over therapist's suggestibility. Therefore sometimes a more "conservative" non-extraction approach has to be implied to satisfy patient's demeanor , even if it is not in the best interest of the patient [39]

5. CONCLUSION

The decision to proceed with extraction or nonextraction of teeth in the treatment of crowding has to be evaluated in the light of advantages and disadvantages of extraction in a particular case during treatment planning. This decision must be based on strong evidence and careful analysis of cephalometry, supplemented by model analysis and soft tissue aspects for each individual case. The treatment should maintain an equillibirium state of craniofacial structures, ensuring the stability of treatment and curtailing the chances of relapse. Latest advancements in techniques and materials have instigated the orthodontists in the present scenario to prefer non extraction treatment in all the possible cases because of the patient apprehension in removal of teeth but extraction of teeth has to be accepted where its indispensible because of severe arch length discrepancy, serious facial profile alterations, soft tissue considerations and functional aspects.

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