

“Controversies with Serial Extraction Procedure as an Early Treatment Modality to Intercept the Malocclusion – A REVIEW”

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Abstract

Various orthodontic procedures are used to intercept a developing malocclusion. The aim of interceptive orthodontics is to reduce the severity of malocclusions. Serial extractions are considered as an early interceptive procedure, but clinical studies suggest their reliability of implementing as a corrective procedure. Controversy with serial extraction procedure as to whether it is corrective or an adjunctive to active treatment is still in debate. Data from various clinical studies and literatures show the procedure can be implemented in either aspect. But case selection and compact diagnosis is needed for the success of the procedure. The limitations of the precise diagnostic tool are a matter of question. This mini review discuss various controversies regarding the procedure right from diagnosis to treatment planning , its pros and cons in implementation to various malocclusions.

Keywords: Controversies, Diagnosis, Serial Extraction

1. INTRODUCTION

Interceptive orthodontic procedures are advocated to reduce the severity of malocclusion occurring at a later stage. Serial extraction is one such interceptive procedure which reduces severity of arch length tooth material discrepancy at an early mixed dentition period there by creating a room for the proper alignment of permanent successors. More precisely Dewel defines that orderly removal of selected deciduous and permanent tooth in a predetermined sequence”. Earlier it was advocated as a corrective procedure and now it has been considered as an adjunctive procedure for the comprehensive orthodontic treatment [1]. But here the controversy arises because there are cases has been treated alone with serial extraction, and also as an adjunct to active treatment. Thus serial extraction procedure cannot be fully considered as an adjunctive procedure [2]. Serial extraction has been in the literature about 271 years ago by Robert Bunnon in his book [3]. Later Kjellgren introduced the term “Serial extraction” which caught attention and made much misconception that merely removing the teeth. Then Hotz changed the term to “Guidance of eruption” meant that the procedure tend to direct the teeth into proper eruption” [4]. He argued that his term was superior to Kjellgren’s serial extraction but the protocols and aims of the procedure were identical. In later years serial extraction has gained popularity. Inadequacy of space in arch can be considered as a reliable indication of serial extraction [5]. According to

Kjellgren malocclusion occur due to contraction of the jaws and there by lack of space to accommodate all complements of teeth. Thus it can be treated with lasting results only by reducing the number of teeth [2]. The success of the procedure lies behind the accuracy in diagnosis and case selection as well as treatment planning [5]. It is always a challenge for an orthodontist in making a decision regarding the treatment can be done with or without extraction [6]. In serial extraction, various methods have been adopted by various legends [7]. In conventional as well as alternative methods, the principle is same and variability in extraction sequence. Data shows both the advantages as well as its deleterious effects have made the procedure a controversy [5,6]. This review describes various controversies with serial extraction right from diagnosis, treatment of class I crowding, variation in sequence ,its effects on facial esthetics, various malocclusions, treatment duration, post retention stability and relapse, cost effectiveness.

2. CONTROVERSIES

2.1 Controversies In Diagnosis

The controversies with serial extraction begins with in diagnosis because serial extraction as a corrective procedure continues to be a source of concern to all orthodontists.³ The challenge in diagnosis lies in growth prediction because the principle of serial extraction is based on assumption that future growth won't be sufficient to accommodate all the teeth in proper alignment. Even the most accurate recent diagnostic procedure available, it still can't be considered as a reliable tool for growth prediction [3]. Arch length evaluation is of utmost importance in cases to be treated with serial extraction. But arch length evaluation is more to be conclusive in lower arch. Thus serial extraction considered to be strange because of simplicity in application but of complicated analytical requirements. A thorough cephalometric evaluation is required for the serial extraction procedure so as to predict the growth status in observation period. In cephalometric evaluation, the position of lower incisors must be analyzed which depicts the exact indication of the serial extraction program. But in most instances, these get neglected. As a part of injudicious extraction decision leads to removal of deciduous cuspids results in excessive lingual inclination of lower incisors, thus arch length can be increased by up righting these incisor teeth [2]. In borderline irregularity cases it is always better to delay the treatment until the permanent dentition period. Serial extraction is much less now because the amount of crowding is severe enough to take a right decision at an early stage for proper alignment [7]. Serial extraction should never be

advocated until and unless with a profound diagnosis. Legal concerns regarding risk management include promiscuous extraction [3].

2.2 Controversies Of Treatment In Class I Crowding

Even if an ideal indication of serial extraction is class I crowding still controversy is there in advocating it. Kjellgren mentioned that there is no resorption seen in deciduous cuspids during the eruption of permanent laterals. The position of laterals would be in a compromised position even if the position of the permanent canines can make favorable in the arch by extraction of first bicuspid, thus incisor crowding can be relieved initially in the mixed dentition period by extraction of deciduous cuspids. He also mentioned that when the eruption of laterals is too early we can strip off the mesial surface of the deciduous cuspids there by creating sufficient space for normal alignment of incisors [2]. The amount of crowding is to be considered while undertaking the procedure. According to Proffit, if there is extremely severe crowding, serial extraction can be advocated [7]. According to Gianelly the treatment for moderate crowding can be initiated at the terminal phase of mixed dentition just maintaining the Leeway Space of Nance and can be considered as a gold standard [8]. There are various modalities for treating the crowding in class I cases [7, 8]. But the result with any of the methods like expansion of arch is questionable regarding the chances of recurrence. Thus effectiveness and efficiency of each modality is to be considered. In literatures as well as in studies arch length maintenance can resolve crowding at a later stage [8]. Serial extraction cases without active comprehensive treatment are rare⁶. Yoshihara et al compared the effect of serial extraction alone on crowding and also investigated the arch length, tooth width and irregularity index. They concluded that serial extraction can be advocated in most cases in order to correct crowding [9]. Studies show that early relieving of crowding in mixed dentition improves the gingival tissues [2]. Thus serial extraction has been successfully advocated for variable malocclusion through clinical experience rather than data from literature.

2.3 Controversies with Serial Extraction In Various Malocclusions

According to clinical experience, Kjellgren advocated the serial extraction procedures in various malocclusions in contrary to ideal indications reported by Dewel². In deep bite cases, the procedure worsens the situation as the loss of posterior tooth as a part of it. In

the dist-occlusion cases having crowded upper arch. The procedure can be advocated in single arch. In cases having open bite due to habits extraction of deciduous canines could intercept. In bimaxillary contraction cases, procedure can be performed in both jaws while in lower arch, it has to be delayed. Similarly class III cases an early intervention of crowded teeth in the lower arch led to a therapeutic approach. In cross bite cases extraction of lower cuspids locked by inversion can favors the correction [2]. But Dewel reported that in class II cases, serial extraction can be used as an adjunctive procedure to comprehensive orthodontic treatment and the procedure could not improve molar relation as well as in the supporting structures [5].

2.4 Controversies With Effects Of Serial Extraction

The deleterious effects by unwarranted extraction led to other controversies regarding the procedure. At the site of first premolar extraction as a part of the procedure leads to uncontrolled tipping of teeth adjacent to the extraction space. The space closure as a result of late premolar extraction is comparatively less tedious than the up righting of teeth [6]. In borderline extraction cases, there will be deepening of bite as a result of early loss of posterior teeth. There is controversy regarding the vertical growth of the individual, as there is absence of teeth in the posterior region will affect it. There is detracting of growth both horizontally as well as vertically due to the lack of normal proximal and vertical function. The other discouraging reactions involve lingual tipping of incisors and the failure of premolars to reach the occlusal level. In normally developing dentition the eruption of premolars follows its deciduous predecessors, conversely in serial extraction cases at an early age there is loss of deciduous first molar , thus premolars has to take along path of eruption there by creating a space due to loss of posterior teeth. The extraction space thus facilitates tongue thrusting habit. There is loss of premolars as a part of procedure leads to deepening of bite. As an alternative method, where enucleation of premolar buds has been advocated, but there is risk of damaging the cortical plates [6]. Various clinical studies reported that the eruption of permanent successor should happen if there is too early exfoliation of the deciduous predecessor. According to Kjellgren, if exfoliation happens just one year before the eruption of the permanent teeth, it favors or in another way it accelerates the eruption as explained by the strong eruption promoting effect [2]. Studies has been reported that post treatment root resorption as well as the levels of alveolar bone is much maintained in serial extraction procedures without active orthodontic treatment [10]. But

in contrary Brin et al found out that there is similar apical root resorption in serial extraction followed by fixed mechanotherapy compared to late premolar extraction. They mentioned about the mechanical factors affecting root resorption and thus the timing of appliance wear and the treatment duration is similar in both the groups [11]. But the point to be taken is that previous all studies reported that the resorption is less pronounced in patients treated with serial extraction alone and not with active orthodontic intervention.

2.5 Controversies With Serial Extraction Affecting Facial Esthetics

Overemphasis on straight facial profile considering lip fullness in the early transitional period led to extraction of teeth. But it is a transient phenomenon, thus lip fullness can't be considered as reliable criteria for the extraction of teeth, thus early extraction leads to ditching of the face and finally gave a concave profile [6].

Faster and continuous growth of nasal structures compares to other facial counterparts is another controversy. Similarly the chin remodeling occurs as a part of maturation of face. So if the growth of lower half of the face is retarded as a result of early extraction, while nasal and chin counterparts continue to grow leads to a concave /dished appearance. Thus the predictions of remodeling of these structures were always questionable [6]. It is true that serial extraction itself can bring the proper incisor alignment and posterior occlusal relation. In majority of the cases requires long term phase II comprehensive treatment.

Glauser et al conducted a study in Navajo Indian patients and found out differences in dental measurements that there are upright maxillary and mandibular incisors in serial extraction patients compared to untreated group. And these values didn't produce any effects such as the esthetic fullness of lower lips or deepening of bite. There were no significant side effects in the patients with serial extraction group like periodontal defects, deepening of bite. But a small amount of residual spacing has been reported. Thus he concluded the serial extraction can be advocated as a treatment modality without comprehensive orthodontic procedures and provide beneficial results [12].

Wilson et al mentioned about the changes in the position of mandibular incisors in serial extraction with active orthodontic treatment compared to late premolar extraction and soft tissue changes are not much noticeable in both methods [13].

2.6 Controversies With Serial Extraction Sequence

There is an alternative sequence of serial extraction is reversing the removal of deciduous molar before cuspids. In borderline irregularity cases, there is uncertainty in first premolar extraction as the remaining growth might be sufficient to accommodate all teeth. But this will be favorable for certain conditions which should be present in arch such that both the deciduous cuspids should be present, moderate arch length loss and there is minimal crowding of incisors. Thus when there is a moderate arch length defect, favorable skeletal pattern and a good muscular balance is there, the orthodontist must be careful to take a judicious decision regarding the treatment thus avoiding drastic errors. So the proper course is to follow up the case thoroughly and analyze the growth of respective individual. If the growth is good, there is no need for extraction line of treatment, if the growth is questionable, further development will not be affected by the extraction. In the class I cases the active treatment can be delayed until the eruption of cuspids.⁶ Even though the treatment modalities and protocols are similar for Kjellgrens and Hotz methods, Kjellgren recommends the extraction of first bicuspid only when they were completely erupted and one half of the root completion of canine has occurred [2]. He was concerned about the mesial drifting of the adjacent teeth into extraction space especially when the canine has not erupted completely. Conversely Hotz was more concerned about this in maxillary arch, where second bicuspid erupts ahead of canines [4].

Fanning et al reported that after the removal of first deciduous molars at 4 years of age, there will be an initial spurt for the eruption of bicuspid and later it will get delayed and remain stationary compared to its antimere [14]. Studies showed that if deciduous first molar got removed before half of root length of permanent successor had formed then it will lead to failure of its eruption. According to Jack G Dale, serial extraction will be favorable in maxillary arch, as the eruption of bicuspid happens before canine, so that maxillary incisors are not held forward, but conversely in mandibular arch as the canine precedes the eruption of bicuspid [15].

2.7 Controversies With Serial Extraction In Treatment Duration

Serial extraction will be advocated only by thorough diagnosis, or else results will be worse. Jack G Dale reported that proper case selection, sound diagnosis

followed by the implementation of procedure reduces the treatment duration, cost of treatment, patient discomfort and potential iatrogenic sequelae. The etiology of mixed dentition crowding should be taken into consideration as it may be either due to hereditary factors or else due to environmental factors. If the discrepancy is due to hereditary factors, serial extraction can be advocated while due to other reason, it won't give better results. Norman in early years mentioned that it is impossible to omit comprehensive orthodontic treatment by serial extraction, data shows only limited number of cases can be treated successfully with serial extraction alone [16].

Little et al concluded the post retention stability as well as relapse tendency is less in serial extraction cases than late premolar extraction cases because the time for active treatment is less, so there is comparatively less stress on the bone there by yielding more stable results [16]. Comparative studies by Wagner has been conducted between the treatment time of serial extraction as well as late premolar extraction [18]. There is considerable reduction in active treatment time in severely crowding cases. But a prolonged observation time needed for serial extraction cases. Studies show the treatment outcome with PAR index [19] give almost similar occlusal outcomes with serial extraction as well as late premolar extraction. Kjellgren also mentioned about the attaining similar outcomes with early serial extraction procedures compared to late premolar extraction cases, but pertained to some cases and not been considered as a treatment goal.

Ringenberg et al reported the procedure of serial extraction has not provided any ill effects when compared with late premolar extraction and concluded the treatment duration of the serial extraction method shows a comparative reduction compared to the other group. In his study he mentioned about deepening of bite occur in serial extraction patients due to the up righting of incisors rather than due to supraeruption [20].

In recent studies by O'Shaughnessy et al compared the efficiency of serial extraction and late premolar extraction in severe crowding cases where they found out that the treatment outcome is quite similar in both the groups and there is reduced active treatment time in serial extraction groups, but a prolonged observation time precedes the active treatment in serial extraction groups [21].

Even if the total treatment duration of the serial extraction is more, it will improve the self esteem of patients to see the well aligned teeth at an early stage. Most of cases that were treated with serial extraction

have to go through premolar extraction followed by the comprehensive treatment.

The cost effectiveness of the procedure means the inputs what the patient put and what they achieved after the treatment. This is another aspect of serial extraction. Dale briefly mentioned that serial extraction procedures reduced the cost of overall treatment for patient. But he could not substantiate it. Later Richmond et al measured the cost effectiveness By PAR reduction as a part of treatment [22].

2.8 Controversies Regarding the Stability and Relapse of Serial Extraction Treatment

Mc Reynolds et al compared the post retention stability and relapse of serial extraction of mandibular second bicuspid and late premolar extraction of the same tooth where they failed to find any significant difference between the two methods [23].

Woodside et al reported the stability of results of serial extraction treatment has no effect compared to untreated subjects regarding the incisor crowding, inter molar and inter canine width. They found a decrease in arch length which occurred as a part of serial extraction procedure [24].

Haruki and Little stated that “perhaps the key to improved stability is early extraction plus anterior alignment, rather than early extraction followed by physiologic drift” [25].

3. CONCLUSION

Serial extraction is like a double edged sword and requires a compact diagnosis before its implementation. Even if we do an exact prediction of growth by using precise diagnostic tools, it is still questionable and various limitation of this procedure has stood up. Injudicious extractions lead to drastic results and worsen the facial profile and balance. The effectiveness and efficacy of the procedure before planning treatment should be kept in mind. If the procedure is followed by a proper case selection and a sound diagnosis, it will give best results. Controversies exists only where there is pros and cons. Likewise serial extraction has its advantages and limitations. Literatures are not still sufficient to substantiate its benefits and defects. Serial extraction is more of a clinical perspective procedure and it is challenging, hence with a hope for evidence based studies in future.

Conflict of Interest

There is no conflict of interest.

4. REFERENCES

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