

Serial Extraction: A Review

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Abstract

Serial extraction or eruption with guidance is a pre-planned, premature extraction of certain primary teeth to create space that has been compromised. It is followed by the extraction of certain permanent teeth to maintain the proper proportion of tooth size and dentoalveolar bone space. However, this procedure is challenging as it requires in-depth clinical knowledge and skill. This article provides essential insights to the clinicians to identify and categorize the cases meticulously for serial extraction, apply both theoretical and practical aspects of growth and development, and diagnose the alarming signs of primary crowding in early mixed dentition period.

Keywords: Serial Extraction, Primary Teeth, Mixed Dentition, Developing Malocclusion.

Introduction

Serial extraction is fundamentally based on the concept that in certain cases the orthodontists face a challenging situation such as limited space between the arch length and total tooth material. Hence, it is crucial to enlarge the basal bone, so that all the teeth get proper accommodation. To tackle such discrepancy, one has to be skillful enough in both clinical diagnosis as well as basic knowledge regarding the growth and development of teeth so that the dental deformities can be promptly rectified while balancing the proper esthetics².

History of Serial Extraction: Serial extraction has remained an attractive procedure for the dentists since the 18th century. Two French dentists, Bunon and Bourdet were among the pioneers who explained that the extraction of more than one uneven teeth can enhance the

aesthetic of the rest. Paison was the first to recommend the procedure to relieve the crowding and align the teeth. Robert Bunon in 1743, in his publication "Essay on Diseases of Teeth", first wrote about the importance of early extractions. Linderer (1851)⁵ suggested that the primary canines should be stripped or removed to accommodate the lateral incisors followed by the extraction of 1st premolar as to provide sufficient space for the eruption of molars. From the 1850s, for nearly two centuries, there was no marked improvement to the concept of serial extraction. However, after the second world war, a new era of modern serial extraction was established by many dedicated dentists such as Kjellgren of Sweden, Hotz of Switzerland, Heath of Australia, and Nance, Hoyd, Dowel and Mayne of the United States. Despite working independently during the period of compromised communications because of the second world war, Kjellgren and Hotz reached a common conclusion of the extraction sequence.

In 1929, Kjellgren coined the term "Serial Extraction" to describe a procedure where certain deciduous teeth were extracted followed by the extraction of permanent teeth to facilitate an uninterrupted eruption of the rest of the teeth. In 1940, Nance presented illustrated his technique of "progressive extraction" and has been called "Father of Serial Extraction philosophy" in the United States. In 1941, Rudolf Hotz suggested the

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term “Guidance of dental eruption by extraction” or “Guidance of eruption”. As per him the term “guidance of eruption” is self-explanatory and comprises of all measures available for tooth eruption.

Overview of Dental Development:

- 1. Incisor Liability:** The term “incisor liability” was first coined by Warren Mayen. It is defined as the difference between the amount of space needed for the incisors and the space available. In maxilla, it is 7.6 mm while in the mandible it is 6 mm. However, there is individual variation in incisor liability
- 2. Inter-dental spacing:** In young patients, the interdental gap may vary from 0 to 10.0 mm (average 5.0 mm) in the maxillary arch, whereas in the mandibular arch, it fluctuates from 0 to 6.0 mm (average 3.0 mm). Lack of space is an obstacle for achieving proper alignment.
- 3. Inter-canine width change:** During mixed dentition, the arch widens in between the primary canines compared to the primary dentition. Maxillary inter-canine widths coincide with the period of exchange between late mixed dentition to early permanent dentition but mandibular inter-canine width changes a little mostly after 10 years of age.
- 4. Arch-length changes:** The total arch length from the mesial surface of the left permanent first molar to the opposite side changes over time. Normally mandibular arch length decreases while growing.

Why serial extraction is essential?: Dental crowding is one of the most prevalent malocclusions which occurs either due to deficient arch length or limited bone space or extra tooth material. To overcome this, we have to either reduce the tooth size or expand the dental arches. As there are chances of relapse even after the expansion of alveolar basal bone so the following factors should be taken into consideration. Physiologic tooth movement: Human dentition shows a physiologic tendency to move towards an extraction space. Thus by specific extraction of some teeth the remaining teeth which are in the process of eruption are influenced by the natural forces into the normal occlusion.

Indications: “When a pedodontist sees a child 5 or 6 years of age with all the deciduous teeth present in a slightly crowded state or with no spaces between them, with a fair degree certainly, that there will not be enough

space in the jaw to accommodate all the permanent teeth with proper alignment” (Lysell 1960). The reason behind the need of serial extraction are early loss of primary teeth, arch length and tooth material discrepancy, lack of interdental spacing, lingually placed lateral incisors, unilateral primary canine loss and midline shifting, mesially erupting canines concerning lateral incisors, the mesial drift of buccal segment, flaring, ectopic eruption, ankylosis, etc, gingival recession on labially tipping incisors, ectopic eruption of permanent maxillary first molars resulting in early exfoliation of deciduous second molars

Contra Indication: Serial extraction should be avoided in certain conditions which include congenital absence of mandibular second premolars, mild to moderate crowding, deep or open bites, cleft lip and palate cases, spaced dentition, anodontia/oligodontia, midline diastema, dilacerations, Class I malocclusion with minimal space deficiency, reverse overjet, deep bite, open bite, rotation, gross malposition, crossbite and severe class 2,3 of dental/skeletal origin.

Benefits: A surgical procedure not only affects the target tissue but also the tissue around the target. Some of the advantages of serial extraction are like reduced duration of the treatment & future appliance therapy, less psychological trauma experienced by the child, more utilization of physiologic force to achieve a normal occlusion, cost-effective, and chances of caries is decreased as better oral hygiene is achieved.

Drawbacks: It needs proper clinical visualization and judgment. The treatment duration can exceed the expected time frame necessitating multiple visits to the orthodontist. Hence, a high degree of patience and cooperation is needed from the patients. Sometimes it may develop tongue thrust and mandibular permanent canines may erupt ahead of 1st premolar into extraction space of the first primary molar, impacting premolar which leads to a strenuous extraction. “Serial extraction has both its pros and cons but the pros outweigh all the cons”

Diagnostics Tools: Case history, Clinical assessment, Intraoral periapical radiographs, Orthopantomography, Cephalometric analysis, Intra and extraoral photographs, Study models, Functional analysis Mixed dentition space analysis are a must to diagnose a case of serial extraction.

Treatment Planning

Selection of Teeth for Extraction:

1. Primary canine: The four deciduous cuspids are extracted so that optimum space can be created for the alignment of the teeth and lingual crossbite of interiors can be avoided.
2. Primary 1st molar: 1st primary molars are extracted for the uninterrupted eruption of first premolars. But in this process, the rate and amelioration in crowding is decelerated.
3. Erupting 1st premolar: When the upper permanent canine is erupting it is advisable to remove the first premolars as it is the essential step of serial extraction. The next it should be rechecked if the teeth are sound and healthy enough to continue the process and relieve of crowding to justify the extraction of 1st premolars.
4. Enucleation permanent canine buds provide maximum distal translation of which is not required in some cases because it protrudes the chin.

Procedure: There are several methods of execution of serial extraction. The method of choice is dependent on each individual. The techniques are described below

Dewel's Method (CD4): In 1978, Dewel suggested a 3-step technique of serial extraction which is still popular and even being used nowadays.

Step 1: This step comprises of removal of primary cuspids which results in the creation of space for the normal alignment of the incisors. At the age of 8-9 years, this step is executed

Step 2: At the age of 9-10 years, this step is carried out i.e., almost exactly after 1 year primary first molars are extracted to speed up the eruption of first bicuspid.

Step 3: In this step, the erupting first premolars are removed to make some space for the permanent canine to erupt into the spaces that have been vacant by the first premolars.

A modified DEWEL'S method is applied to some cases where the first bicuspid is enucleated at the time of removal of primary molars mostly in the lower arch as the canines follow the regular erupting pattern.

Tweed's Method: In 1966, Tweed recommended that all primary molars should be extracted by the age of

9 years followed by the removal of the first bicuspid and the primary cuspid.

Nance Method: The procedure followed in this technique is the same as that of the Nance method. It suggests the removal of the primary molars followed by the extraction of the first bicuspid and deciduous canines.

Grewe's Method: Grewe's method of serial extraction usually focuses on the planning of extraction patterns for a variety of clinical cases.

Moyer's Method: Central incisor region is prone to crowding. In that case, Moyer's method is recommended.

Step 1: All primary lateral incisors should be extracted to prevent the malalignment of the central incisors.

Step 2: Then after 7-8 months, all the primary canines are extracted to permit space for the accommodation of central incisors.

Step 3: This step includes extraction of all primary first molars which further accelerates the eruption of first bicuspid.

Step 4: In this ultimate step, all the first premolars are removed after 7-8 months so that speedy and uninterrupted eruption of canines can occur.

Role of Pedodontist: In serial extraction, pedodontist and orthodontist should have mutual understanding for treatment planning. A pedodontist should observe the problem, provide appropriate treatment planning for serial extraction, convince the patient or parents, and refer the case to the orthodontist for future correspondence.

Conclusion

Serial extraction is a matter of time, patience, proper implementation of knowledge and clinical skill for accurate diagnosis, and most importantly follow up. Along with this deficient arch length, the amount of crowding, and health of the remaining hard and soft tissues must be considered. The objective of this technique is to intercept the developing malocclusion at an early mixed dentition period so that further malocclusion can be interrupted. Although this procedure does not eliminate the need for comprehensive orthodontic treatment, however, it can lessen the duration of treatment. Treatment can't be avoided for midline diastema, root parallelism,

incisor angulation, and other malalignments. Thus serial extraction helps in rectifying these irregularities to some extent.

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