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SERIAL EXTRACTION- A REVIEW OF LITERATURE

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ABSTRACT

Serial extraction is a sequential plan of premature removal of one or more deciduous teeth in order to improve alignment of succedaneous permanent teeth and finally removal of permanent teeth to maintain the proper ratio between tooth size and available bone. It is an optimistic treatment procedure in interceptive orthodontics, which is generally applied in minimal discrepancy cases in which the total tooth material is more than the supporting tooth material.

INTRODUCTION

Dental crowding exists when there is an excess of tooth material in relation to the basal and alveolar bone that supports the teeth¹. Inadequate growth of supporting bone is responsible for the development of the procedure known as serial extraction. It is designed to anticipate and prevent the development of a fully matured deformity in the permanent dentition, and it is applied by the extraction, in the proper order, of a predetermined series of deciduous and permanent teeth². Serial extraction is a series of related and correlated steps taken in an attempt to intercept a developing malocclusion in the mixed dentition³.

HISTORICAL DEVELOPMENT

Serial extraction has a longer historical record than has generally been realized. The earliest attempt at guiding the eruption of permanent teeth by the extraction of deciduous teeth in retarded arches was made by a French man, Robert Bunon, in 1743³. In 1929, Kjellgren introduced the term serial extraction. The sequence consisted of

- 1) Extraction of primary canines to permit self-alignment of permanent incisors
- 2) Extraction of primary first molars to promote the eruption of the first premolars
- 3) Extraction of first premolar to relieve the crowding and permit the eruption of the permanent canines¹.

The extraction sequence advocated by Bunon more than 200 years ago is virtually identical to that of today². The interest in serial extraction increased following World War II when Hotz, Kjellgren, Dewel and Heath published their findings on various extraction sequences¹. Holtz referred the procedure as "guidance of eruption". This is better title than Kjellgren's because it implies that knowledge of growth and development is necessary to direct the teeth as they erupt into occlusion⁴.

DEFINITIONS

Serial extraction is the planned and sequential removal of primary and permanent teeth to intercept and reduce dental crowding problems¹.

Dewel has defined the procedure referred to as serial extraction as the early removal of selected primary and permanent teeth in a predetermined sequence⁵.

The term serial extraction implies the removal of selected teeth in an orderly manner over a prolonged period of time⁶.

Serial extraction may be called the early recognition or anticipation of a deformity that will occur unless teeth are removed at strategic intervals to relieve in intensity the developing malocclusion⁷.

Serial extraction can be defined as the correctly timed, planned removal of certain deciduous and permanent teeth in mixed dentition stages with dento alveolar disproportion in order to alleviate crowding of incisor teeth, allow unerupted teeth to guide themselves into improved positions and to lessen the period of active appliance therapy or eliminate it⁸.

Serial extraction refers to the sequential removal of deciduous teeth to facilitate the unimpeded eruption of permanent teeth⁹.

RATIONALE

The rationale for serial extraction is based on several biologic facts and processes;

- 1) Tooth material arch length deficiency
- 2) Physiologic tooth movement
- 3) Normal dental, skeletal, and profile development

Mayne points out that serial extraction should be limited largely to those cases that have good faces, those that present harmony and balance of two tissue systems, bone and muscle, and varying degrees of harmony in the tooth size¹⁰.

REVIEW OF LITERATURE

Dewel suggests that serial extraction can be applied in certain Class II and Class III irregularities but almost invariably only as a part of treatment already in progress. In class I serial cases active orthodontic treatment more often is postponed until a later date and frequently it can be omitted

entirely. He stated that mandibular arch is the final diagnostic guide, with particular emphasis on the harmonious relation of the mandibular incisor to the basal bone. Slight irregularity or moderate

crowding is not abnormal but extreme crowding, gingival recession and premature loss of deciduous mandibular canines are not acceptable deviations from the normal⁷.

Lloyd (1956) said that patients with short arch lengths or very short intercuspid width would be suitable cases for serial extraction. He advised serial extraction to be done in all types of class I malocclusion and class II div I malocclusion that show a severe lack of arch length or severe lack of intercanine space in both jaws to accommodate the incisor teeth in non-rotated position¹¹.

They are further characterized by a good facial profile, the overbite ranges from slight to severe and age of patient is somewhere between 6 and 9 years. Malocclusions that have lingually locked maxillary incisors i.e. anterior cross bite or buccal teeth in cross bite or that lack occlusion but show deficient arch length or lack of intercanine space are mechanically treated for a short period until the cross bite is changed and serial extraction is continued.

Bimaxillary protrusions show beneficial results from serial extraction procedure. A lip retracting exercise in these cases is helpful in the uprighting and lingual positioning of the incisors. It is suggested that a headplate be used to supplement the diagnosis.

Another type of malocclusion where serial extraction can be helpful is that in which mandibular arch has sufficient arch length with excellently aligned incisors but in which the maxillary arch shows a decided lack of space for the erupting lateral incisors due to forward eruption of buccal teeth rather than to lack of intercanine space. Early removal of maxillary deciduous canines will prevent the lingual locking of the maxillary permanent lateral incisors.¹¹

Maj and Luzi (1960) suggested that serial extraction should not be prescribed in those cases in which alveolar growth increments can be successfully stimulated and a good long lasting correction can be achieved with a full complement of teeth¹².

According to **Mayne (1968)**, if the crowding is extremely severe, with irreparable insults occurring to the investing tissues, then logic demands the early removal of deciduous cuspids, permitting the most rapid unravelling of the crowded teeth and their greatest lingual adjustment, both these accomplishments will improve investing tissue health¹³.

Proffit writes that only when there is extreme severe crowding of 10mm or more is there a chance that a reasonably satisfactory result can be achieved by serial extraction alone¹⁴.

Dewel (1969) concluded that an authentic serial extraction case has markedly irregular anterior teeth, premature loss of one or more of the deciduous canines, various median line deviations, impacted or displaced lateral incisors, a gross reduction in arch length and frequently, gingival recession and alveolar destruction along the labial surfaces of one or both the central incisors. Cephalometrically, the typical class I extraction case presents a flat or straight facial pattern and the incisors are vertical and in a more acceptable relation to the N-Pogonion facial plane¹⁵.

Giorgio Maj (1970) advocated the removal of deciduous canines when lack of space for mandibular incisor is greater than 2.5 mm. This would allow better alignment of incisors and

prevent any tissue damage in the region of malposed teeth¹⁶.

Ruff (1976) concluded that in class I mixed dentition cases, decision for serial extraction should be made only after the size of unerupted teeth is determined and after at least one year of growth observations verified by cephalometric analysis. Cases with a discrepancy of 4 mm or more still have a chance, if the growth potential is good¹².

Cases showing a greater arch length discrepancy will generally become extraction cases.

Odenrick and Troeme (1985) proposed when cephalometric evaluation indicates an orthognathic or retrognathic profile, slightly hyper divergent, with facial skeletal dimensions less than average, in a patient whose dental casts indicate above average incisor width, serial or early extraction therapy is one of the treatment modalities that may be considered¹⁷.

Jacquelin and Berthet (1991) proposed that serial extraction has limited indications which need to be respected in order to preserve the child's future dental health. It is indicated for class I malocclusion with severe crowding or moderate crowding associated with bimaxillary protrusion.

FOR BORDERLINE CASES:

According to **Dewel (1969)**, borderline cases generally have good facial patterns, moderate loss of arch length, a good muscular environment and a satisfactory direction of skeletal growth. Drastic procedures should be avoided, all possible diagnostic records be secured and then place the patient under observation to determine whether his individual growth trend will make it possible for him to retain all of the teeth¹⁹.

According to **Maj (1970)**, a favorable element in the borderline cases is the presence of a space of 1-2 mm between unerupted second molar and the distal surface of the first molar²⁰.

Jacob Harris (1972) feels that lower arch presents the more difficult problem in determining whether or not a case will require extraction. Maxillary arch is often amenable to treatment with various types of headgear and/or palatal splitting devices in order to increase arch length²¹.

Dewel (1976) suggests that if the dental arches are fairly well developed and if there is only a moderate discrepancy between tooth mass and supporting bone it may still be possible to retain all the teeth. If incisor alignment is also acceptable than the patient should only be placed under preliminary serial supervision in order to determine future growth trends. It will also help to avoid all extraction errors until a time arises when growth prediction can be established on a more rational basis¹⁸.

Lieberman (1984) claimed that these borderline cases can be started without tooth extraction with a specific time limit set for reevaluation. The initial response to treatment may guide the orthodontist to continue on non-extraction basis or to revert to tooth extraction. The term 'therapeutic diagnosis' has aptly been applied to describe this procedure²².

LIMITATIONS

Dewel (1954) commented that even when serial extraction is necessary, premature removal of teeth involves the risk of retarding future development in arches that are already deficient²³.

Bjork (1951) believes extraction of deciduous teeth for correction of crowding not justified as it retards the basal mandibular growth⁴⁵.

Dewel (1957) found that even when authentic serial extraction is indicated, premature removal of teeth involves the danger of retarding future development in arches that already are deficient. Also, prolonged absence of teeth in the premolar region permits the tongue to flow into the space which results in a major problem in habit correction during the active stages of treatment⁶.

Lloyd (1956) found that disadvantage of serial extraction is some lingual inclination of the

incisor teeth particularly the mandibular incisors which cause their elongation and increased incisal overbite. Use of a lingual appliance may minimize lingual inclination⁷.

Moorrees (1965) research showed that as the mandibular permanent incisors erupt the primary mandibular canines move laterally. When these teeth come into occlusion with the primary maxillary canines, they in turn are moved laterally (secondary spacing) and the space created enables the permanent maxillary lateral incisors to emerge into a favorable alignment. If the primary canines are extracted, when this natural phenomenon is occurring secondary spacing may not occur²⁵.

Salzmann (1966) wrote that since it is not possible to predict the exact time of tooth emergence on the basis of the root length of the teeth or the chronologic or skeletal age of the patient, extraction of deciduous molars actually can initiate malocclusion²⁶.

Ringenberg (1967) listed the disadvantages of serial extraction as increased overbite, lingual tipping of incisors, scar tissue in the extraction space, diastema and alteration of tongue function²⁷.

Mayne (1968) pointed out that inadequate attention has been paid to those situations which accounts for many cases of serial extraction resulting in 3-5 mm of spacing remaining in the

extraction site. Space which must be closed through anterior movement of remaining posterior teeth²⁴.

Dewel (1969) concluded that active mechanotherapy has to be instituted to close the remaining spaces, to open the bite, upright teeth on either side of extraction sites and realign rotated and malposed incisors and canines. It has been disillusioning to learn that serial extraction, in itself rarely creates acceptable occlusal relation and that certain adverse reaction will result if procedure is not followed by comprehensive orthodontic treatment²⁸.

Freeman (1977) reported in a study of 1455 patients that only 1% of the patients treated with

serial extraction would not need orthodontic treatment. 81% will need full banded orthodontic treatment²⁹.

Dewel (1976) reported that extraction decisions are much more difficult and demanding in the early mixed dentition than in the later permanent dentition³⁰.

Persson (1989) performed a longitudinal study on serial extraction cases and found that despite earlier tooth removal on average crowding developed to about the same degree as that of a non-extraction normal occlusion sample³¹.

Little, Riedel and Eugst (1990) evaluated the long term serial records of patients who had undergone serial extraction plus comprehensive treatment and retention and found that the anticipating future stability, the primary rationale for serial extraction, was not confirmed in their study. They realized that

post retention irregularity is an inevitable response in cases with inadequate pretreatment arch length³².

Grabber writes that the removal of the first premolar allows the tipping together of the crowns accentuating the "V" or "ditch". Seldom does the distance between the apex of canine and mandibular second premolar decrease on its own¹⁵.

Hollander (1992)³³ reported that although extraction of canine on the opposite side is advocated following unilateral loss of canine and has been taught for many years, no data exists to confirm that the midline will resolve automatically with extraction of antimere leaving the stability of incisor symmetry in question. He says it would be more beneficial to leave the antimere intact³³.

Wagner and Berg (2000) in a study found that the number of appointments was significantly higher and the total duration of treatment/observation time was significantly longer for serial extraction cases than for extraction and orthodontic treatment done in permanent dentition. However, the results and outcome of treatment was similar in both the groups³⁴.

CONCLUSION

The dental profession has been excited to an undue degree by the hope that serial extraction alone would solve all class I discrepancy irregularities. It has been disillusioning to learn that serial extraction, in itself, rarely creates acceptable occlusal relation and that certain adverse reactions will result if the procedure is not followed by comprehensive orthodontic treatment. It is true that, when indicated, serial extraction leads to varying degree of self-correction and that it therefore has certain interceptive qualities.

Serial extraction does not eliminate the need for comprehensive orthodontic treatment. However, it can shorten the length of treatment considerably. Treatment is still needed for important refinements such as root parallelism, midline alignment, incisor angulation, overbite and overjet correction and idealizing the occlusion.

Yet there also are a large number of deceptively similar borderline malocclusion cases that should instead be treated either with a full complement of teeth and not by serial extraction or by postponing all potential extraction decisions until the permanent dentition completely erupts.

Unfortunately, serial extraction is not a panacea for our post retention problems of relapse. The procedure known as serial extraction has been essentially a program of patience, of continuous observation and study, of proper timing, and of delay and postponement until growth and development have accomplished their mission. Thus serial extraction is now looked upon as a way of reducing the severity of developing malocclusion, an adjunct to later treatment and a means to make comprehensive treatment easier and often quicker.

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