SERIAL EXTRACTION: IS IT A PANACEA FOR CROWDED ARCHES?

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ABSTRACT

Serial Extraction or the guidance of eruption is an age old procedure to correct crowded arches and is still used in routine dental practice. But the efficacy of this procedure has always been controversial and it requires very precise clinical skill for a favorable outcome. This article presents a review regarding the proper selection of cases for serial extraction, its limitations and various adjuncts that are required to get good results.

INTRODUCTION:

Intercepting certain forms of malocculsion with a preliminary program of serial extraction has a legitimate place in orthodontics. Dewel defines serial extraction as an orthodontic treatment procedure that involves the orderly removal of selected deciduous and permanent teeth in a predetermined sequence.

Serial extraction is based on the premise that in certain cases the orthodontist is confronted with a continuing discrepancy between total tooth material and deficient arch length. He is presented with a limited amount of basal bone, present or potential, in which to reposition rotated, malposed or blocked out teeth. Any effort to enlarge that base to accommodate all the teeth far too often is rewarded with relapse and failure.

It demands a fine sense of clinical diagnostic skill, perhaps more than in any other area of orthodontic practice. Although it is deceptively simple in appearance and application, irreparable damage can be done when it is improperly applied. The orthodontic responsibility is to differentiate between (1) those cases that will respond to ideal treatment with a full complement of teeth and (2) those that must submit in the beginning to compromise measures if relapse and a time consuming second period of treatment with extraction are to be avoided.

HISTORY:

The procedure goes back to 18th century – principally to two Frenchman Bunon and Bourdet. They were among the first of several early writers to describe the removal of certain deciduous and permanent teeth in under developed arches to give the remaining teeth acceptable functional relations.

Robert Bunon,[23] in his Essay on Diseases of Teeth, published in 1743, made the first reference to early extractions.

Linderer[23]**(1851)** wrote that quite often in order to accommodate lateral incisor, one must strip or extract deciduous canines and to relieve subsequent crowding in buccal segments, removal of first premolar would be necessary.

Strangely their early recommendations were ignored for nearly two centuries. It was not until the 1947-48 Transactions of the European Orthodontic Society had been published that the procedure was again presented. Working separately during the early 1930's and 1940's, Switzerland's Rudolf Hotz and Sweden's Birger Kjellgren independently arrived at extraction sequences that were identical. Since there was little communication during World War II, neither knew of the work of the other. Kjellgren used the term 'serial extraction'. Hotz suggested the equally acceptable and perhaps the more descriptive term of 'guidance of dental eruption by means of extraction'. These men urged a cautious rather than precipitous approach to all extraction decisions.

These same words of warning against indiscriminate extractions were stressed by America's **Dewel**[5] in his 1954 article based on his identical extraction sequence that also had its origin in the mid – 1930s. Still later Tweed suggested the term 'preorthodontic guidance'[23].

Nance presented clinics on his technique of 'progressive extraction' in 1940's and has been called the Father of serial extraction philosophy in the U.S.[23]

REVIEW OF LITERATURE

Selection of cases:

Dewel[4] 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 are not abnormal but extreme crowding, gingival recession and premature loss of deciduous mandibular canines are not acceptable deviations from the normal.

According to **Lloyd**[20]**(1956)** 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 position. They are further characterised 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 crossbite or buccal teeth in crossbite 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.

Maj and Luzi[21]**(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 teeth.

According to **Mayne**[23] **(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 health.

Profitt[28] 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 alone.

Dewel[3] **(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 plane.

Giorgio Maj [22]**(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 teeth.(Fig. 1)

Ruff [31] **(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 good. Cases showing a greater arch length discrepancy will generally become extraction cases.

Odenrick and Troeme [26]**(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 considered.

Jacquelin and Berthet[16] (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.

Borderline cases:

According to **Dewel[3](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 teeth.

According to **Maj[22] (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 molar.

Jacob Harris [15](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 length.

Dewel[6] (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 basis.

Lieberman[18] (1984) claimed that these borderline cases can be started without tooth extraction with a specific time limit set for re-evaluation. 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 procedure'.

Limitations:

Dewel [5](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 deficient.

Bjork[23] (1951) believes extraction of deciduous teeth for correction of crowding not justified as it retards the basal mandibular growth.

Dewel [4](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 treatment.

Lloyd [20](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 minimise lingual inclination.

Moorrees [24](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 favourable alignment. If the primary canines are extracted, when this natural phenomenon is occurring secondary spacing may not occur.

Salzmann [32](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 malocclusion.

Ringenberg [30](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 function.

Mayne[23] (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 teeth.

Dewel [3](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 treatment.

Fig. 1 Case of removal of decidous canines

Fig. 2 Mandibular lingual supporting appliance

Freeman [8](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 treatment.

Dewel [6](1976) reported that extraction decisions are much more difficult and demanding in the early mixed dentition than in the later permanent dentition.

Persson [27] (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 sample.

Little, Riedel and Eugst[19] (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 postretention irregularity is an inevitable response in cases with inadequate pre treatment arch length.

Graber [11] 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 own.

Hollander[12] (1992) 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 intact.

Wagner and Berg[35] (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 groups.

VARIATIONS AND ADJUNCTS

According to **Maj[22] (1970)** a lingual supporting arch in the mandibular arch may be placed to prevent the first permanent molars from drifting mesially after the loss of second deciduous molars.

Profitt [28] writes that if it is clear that extraction is required, serial extraction in a patient with relatively small discrepancy may simplify later treatment, even though closing residual spaces with fixed appliances certainly will be required.

Graber [11] writes that occasionally, it is advisable to remove the second premolars instead of first premolar especially in cases of an open bite tendency. This reduces the tendency to relapsing open bite and lingually inclined incisors that are seen sometimes with lower first premolar removal. There is no harm in placing an acrylic bite plate in the mixed dentition. It would help in preventing overclosure, stimulating eruption of posterior segments and eliminating functional retrusion.

Stemm RM [33] (1973) recommended a similar sequence of treatment but one which does not indicate the removal of permanent teeth. It was termed timely extraction. It was advocated for children with an inadequacy of arch length of over 4

mm but less than 8 mm where eventual extraction of four first bicuspids is a possibility.

Taylor [34] (1971) advocated the use of removable appliances immediately after the teeth are extracted. These appliances are designed to guide the occlusion as much as possible with tipping movements. This approach is termed controlled serial extraction.

Dewel (1954)[5] proposed that serial extraction therapy may require mandibular lingual supporting appliance (Fig. 2) to prevent mesial migration of molars and further collapse of arches. Acrylic bite planes are occasionally indicated to encourage further vertical development during supervision.

Lloyd (1956)[20] concluded that in deciding the serial extraction procedure the first suggested removal has been of deciduous canine. Occasionally, it may be necessary to remove mandibular deciduous lateral incisor due to lack of space for erupted permanent central incisor and then follow serial extraction of other teeth.

Richardson (1982)[29] found that very occasionally, extraction of an incisor tooth may give a good result. It may be appropriate where the jaws are narrow and the teeth fanned out laterally, where the incisor is the seat of pathology such as dense in dense or periodontal disease or where the tooth is excluded from the arch.

SUMMARY

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. Unintercepted crowding causes individual tooth position problems of rotation, tipping and overlapping. These problems are solvable with fixed appliance therapy, but the treated positions may be more difficult to stabilize even with long term retention. It is much better to have the teeth erupt into relatively correct positions on their own, which planned extraction can do, thereby reducing later treatment time in braces. Teeth erupting into very crowded positions can suffer gingival tissue damage such as recession, or can be damaged by unusual angles of wear. So serial extraction not only enhances the stability of the final product, it may also prevent irreversible tissue damage to teeth.

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 idealising the occlusion. Thus, it follows that there are in fact, authentic serial extraction irregularities in which extraction is justified.

Yet there also are a large number of deceptively similar borderline malocclusion cases that should instead be treated either (1) with a full complement of teeth and not by serial extraction or (2) by postponing all potential extraction decisions until the permanent dentition completely erupts.

Unfortunately, serial extraction is not a panacea for our postretention 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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