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New Concept of Serial Extraction

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The loss of a tooth is sufficient to change neuromuscular reflexes of an individual as well as the mastication which has an important role in the development of the maxilla. Serial extractions can be a decisive influencing factor in the development of the maxilla, so critical judgment and selection criteria must be used.

Introduction

In 1743, Robert Bunon carried out the first successive extractions of primary teeth in order to correct malocclusion problems. Since then, relatively few changes have taken place in terms of therapeutic conduct. It was two centuries later, in 1929, that Kjellgren first called these "serial extractions" (SE) [1].

The traditional concept of serial extractions consisted of only removing teeth within certain criteria and sequence in order to make space and provide better alignment within the perimeter of the available arch space. It was also felt that this could be done with or without orthodontic treatment.

With the introduction of functional orthopedic techniques (FOT), a new possibility emerged—that of actually increasing the arch space. This became possible because treatment could be started at an earlier age since anchorage was bimaxillary and dental support was not essential [2-5]. Using functional orthopedic techniques exclusively, a phasic growth could be turned into a harmonious one with far fewer mutilations since FOT considerably reduced the percentage of extractions needed [2-5]. This was achieved by exciting growth and correcting mastication at an early age.

If serial extractions are considered as part of the preventive methods in orthodontics because they intercept malocclusion problems, then great care should be taken to ensure that this level of prevention is used adequately. Critical judgment in treatment planning should prevail, and the need for tooth extraction should always be carefully evaluated.

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The new concept of serial extraction is based on the same prerogatives of the traditional method. What has been added is the use of analyses of aisles and curves of eruption as indicators for selection and sequence criteria. This new element, however, modifies therapeutic conduct entirely, and only in rare cases do treatments coincide when traditional concepts are applied exclusively.

Harmonious and ~~Plastic~~ Phasic Growth

There is a natural sequence, rate of growth, and correct mechanism in the growth of parts in order for the end result to be harmonious. Everything is synchronized to function with the best timing possible.

The outcome of a living being is the interaction of two factors: coded information in its cells and influence from environment which may delay or stimulate growth. Growth is an exclusive attribute of living beings, appearing mainly as changes in size [6], while development is the increase of cellular physiology. Growth and development are interwoven in a vital dynamic process to such an extent that the increase of cellular physiology does not necessarily imply an increase in size but appears as a natural consequence. Growth and development should be absolutely harmonious, to the point that at times nature seems to challenge the meaning of its definitions [7].

There is a pattern for the growth of parts which results in the organized overall growth of the entire living being. These patterns are clearly related to ontogeny and phylogeny.

Phasic growth means that some error has occurred in the feedback system, that some defect in its genetic information or some interference with the normal synchronization of internal processes and environment has taken place. Phasic growth implies that the normal sequence of development has been altered; the correct mechanism has changed, and "ideal" timing has been modified. This may happen in one or more parts of the body, causing serious effects on the whole being and vice versa, resulting in growth that is out of phase in time and space.

Man is an open system [8]. Whenever his growth is phasic or becomes phasic, it is necessary to interfere in the parts by verifying the causes and defining new effects and directions for an improved functional result in order to obtain or reestablish a harmonious growth pattern.

The pattern of tooth eruption, dental attrition, mastication, and tooth loss make up an integral part of the overall harmony in terms of ontogenetics and postontogenetics. Any disturbance in the coordination of time and space that may affect these factors will in turn affect those parts with which there are mainly exchanges of energy with the environment (energy and information—genetic and neuronal—are basic fundamentals for life).

The Pattern of Tooth Eruption

Each tooth has a right moment to appear in the oral cavity, and a primary tooth has a time to leave and make way for a permanent tooth. The pattern of primary and permanent tooth loss is directly related to masticatory function.

There is also a right moment for each stage of the eruption process: first, concentric growth of the tooth follicle occurs with a predetermined life-span. Then comes the first phase of active eruption, which is followed by the first phase of equilibrium (in girls, lasting from five to eleven years, ending at approximately thirteen years of age; in boys, lasting from six to twelve years, ending at fourteen years of age; slight variations will occur in both cases, depending on the tooth). Next occurs the second phase of active eruption (lasting from two to three years, ending between ages of sixteen and eighteen, depending on sex and actual tooth), followed by the second phase of equilibrium (achieved by eighteen years of age and probably related to cessation of condylar growth) [9].

Based on their observations of premolars and molars, Darling and Levers [9] divided this pattern into five stages (the follicular stage of first molars was not able to be completely observed, and the division does not apply to third molars because it was not possible to establish their pattern of eruption). Their conclusions were based on the observation of hundreds of orthopantomographic radiographs of patients ranging from two to twenty-two years old. It was also possible with these radiographs to measure the distance between the inferior dental canal (IDC) and the follicle center or "apex" and the IDC and ankylosed teeth (Figs. 1-5).

PATTERN OF ERUPTION
FIRST STAGE: FOLLICULAR

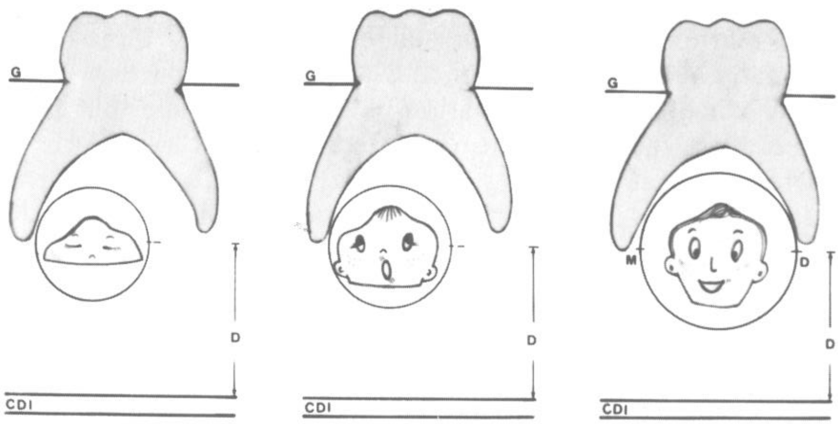

Fig. 1. First stage: concentric (follicular growth—the center of the follicle stays relatively at the same distance from the upper ridge of the IDC (inferior dental channel) for many years. The center of the follicle moves horizontally from lingual to buccal position, and when the M-D (mesial-distal) diameter has been reached, it is best that the center of the follicle is lower than the roots of the corresponding primary teeth. (G = gingiva ridge; D = distance.)

PATTERN OF ERUPTION
SECOND STAGE: FIRST PHASE OF ACTIVE ERUPTION

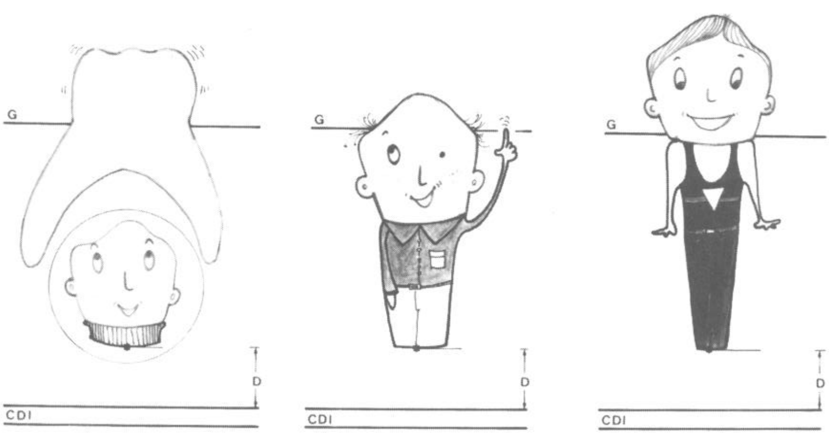

Fig. 2. Second stage: first phase of active eruption—the "apex" stays during nearly the entire stage at the same distance from the IDC. (G = gingiva ridge; D = distance.)

PATTERN OF ERUPTION
THIRD STAGE: FIRST PHASE OF EQUILIBRIUM

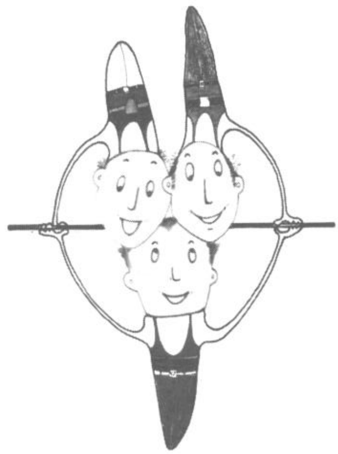

Fig. 3. Third stage: first phase of equilibrium—lasts from two to eight years depending on which tooth. There are no more movements in the occlusal direction. This is attributed to the eruptive force of the antagonists, force applied by masticatory muscles, and perhaps to other, still unknown, contributing elements.

PATTERN OF ERUPTION
FOURTH STAGE: SECOND PHASE OF ACTIVE ERUPTION

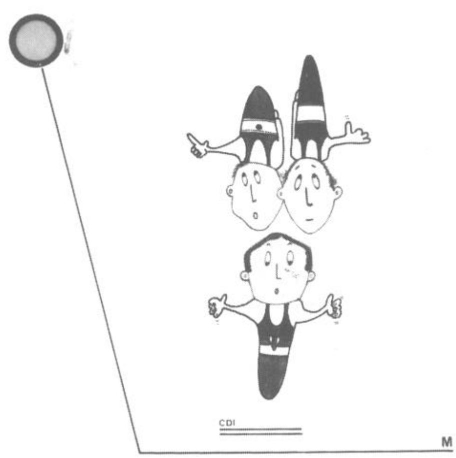

Fig. 4. Fourth stage: second phase of active eruption. The entire tooth, including the apex, moves away from the IDC and moves 2 to 3mm toward the occlusal plane. This is attributed to condylar growth, the force of which separates the maxilla and upsets the equilibrium of the previous phase. (M = mandible; IDC = inferior dental channel.)

PATTERN OF ERUPTION
FIFTH STAGE: SECOND PHASE OF EQUILIBRIUM

Fig. 5. Fifth stage: second phase of equilibrium. When condylar growth ceases, the position of the antagonists is well defined, and no further movement occurs. After the fifth stage, postontogenetic eruptive movements will occur which in turn slowly and progressively increase the distance between the cemento-enamel and muco-gingival junctions. These movements of the teeth as well as the surrounding tissues are continuous in the entire area of the alveolar processes.

After these five stages, postontogenetic eruptive movements of teeth and surrounding tissues (increasing distance beween the cemento-enamel and muco-gingival junctions) have also been genetically programmed in man (by Talari & Ainamo in 1974) [10]. These movements of teeth helped Orban and Gottlieb, in 1938, develop their theory of passive eruption. This term no longer applies to man because human teeth do not extrude from the alveolar bone as they do in other mammals such as sheep and cattle. Ainamo and collaborators, in 1971 [10], studied eruptive movements of mammals, rabbits, and guinea pigs and discovered that when there is constant and intense wear of teeth, a new dental substance continually forms—amelogenesis. With the production of this new substance, inside the alveolar bone also, the tooth finally extrudes. This process does not take place with human teeth.

Observations made by Anneroth and Erickson in 1967, Thompson and Kendrick in 1964, and Talari and Ainamo in 1974-1976 also corroborated the fact that in humans the eruptive movements of teeth, as well as the investing tissues in the area of all the alveolar processes, are continuous (Talari & Ainamo, 1966) [10].

Eruptive movements of teeth and surrounding tissues can be easily observed. Teeth that have long lost their antagonists continue to erupt until they reach the opposite ridge with the entire area of the alveolar processes without extrusion [7].

Postontogenetic eruptive movement is continually recurring and is independent of mastication, attrition, and loss of vertical dimension [11-15]. Attrition and wear are physiological characteristics that play an important part in the function adaptation mechanism of the stomatognathic system. This is a way of compensating and maintaining equilibrium among the structures. Although we only replace teeth once during an entire lifetime, we are able to maintain proper masticatory efficiency up to old age [7].

Planas' Laws of Development

Neural excitation in the form of mastication and occlusal forces affects the development of the jaws in sagittal, transversal, and vertical dimensions and should be considered in the examination and treatment-planning phase of patient care [2, 4, 16, 17].

Sagittal and Transversal Development

The upper maxilla develops on the working side from the force received from mastication by the teeth on this side.

Condylar movement on the supporting side produces neural excitation which provokes growth of the hemimandible on the same side.

Since normal mastication is bilateral and alternated, both sides should receive equal neural excitation.

Vertical Development

There are two dental groups from the mandible: right and left group (two hemiarches); there are three dental groups from the maxilla: right and left group (molars, premolars, and cuspids) and the incisors. Neural excitation of one dental piece of the group is transmitted to all others of the same group.

Mastication plays an important role in maxillary development. Mastication is the total sum of masticatory cycles needed to reduce all food to adequate size and shape to allow, through successive swallowings, total consumption [18].

Curves of Eruption

Eruptive movements of teeth are "curved" in the maxilla and oral cavity and are affected by mastication and maxillary development. Depending on the curves of eruption and mastication, maxillary development in turn is also affected by them.

Studies, in relation to age, of the mean distance of erupting teeth to the inferior dental canal (IDC) and to ankylosed teeth when shown graphically coincided as an S-shaped curve, sigmoid form, with two horizontal asymptotes (third and fifth stages of equilibrium).

Gompertz' equations (1825) can be used for this curve as well as studies on growth, as calculated by the methods of Courtis (1933) and Deming (1957) [19]. However, no one has yet produced a mathematical equation that could describe the course a tooth takes from the initial follicle stage to final eruption. Could it be that of a logarithmic spiral? Could it be part of Moss' theories [20]?

Study of Aisles and Curves of Eruption

Curves of eruption are located in what seems to be true "aisles," and, in order to ensure harmonious growth, teeth should not move out of these aisles. If growth becomes phasic, the tooth will move out of its aisle, and the force, timing, and sequence of eruption will have been altered. Interference with neighboring teeth and antagonists could take place, creating subsequent malocclusion problems.

Analysis of eruption curves and aisles of eruption is done by observing and interpreting, in relation to age, conditions and situation of each tooth in relation to neighboring structures and vice versa.

Radiographic Control

A series of panoramic radiographs should be made with periapical radiographs and clinical examinations. Radiographic control is mandatory when considering tooth extraction or serial extractions of either primary or permanent teeth. This control serves as a valuable aid for keeping track of the development of eruption. Clinical experience confirms the need, in certain cases, of doing panoramic radiograph twice a year.

Periapical radiographs are complementary to radiographic control, especially in cases involving primary canines and molars near replacement time.

Some Observations on Tracing Curves of Eruption

☐ When growth is harmonious, the course of the aisles starts inside the maxilla, depending, of course, on which tooth, by the vestibular or lingual side, far or near, but ends in the correct position at the alveolar crest.

☐ Permanent lower incisors are initially located lingually, while permanent upper incisors are initially located vestibularly. By the end of eruption, they have gone into harmonious positions.

☐ Permanent canines have a more sinuous curve. At the age of three years, they are located high up in the maxilla with the crown turned in a mesial direction with a slight palatal inclination occurring [7, 19]. After the age of seven or eight years, they descend in an occlusal direction, touching the root of the permanent lateral incisor. If something goes wrong at this time and is allowed to persist, resorption of the permanent lateral incisor could occur (although this rarely happens) or teeth could become impacted. There were cases where the pain occurring in the lateral incisor was the chief complaint. In other cases, the permanent cuspid became impacted for lack of extraction of the primary tooth whose root resorption often, for one reason or another, had not even started. This is one of the few conditions that warrants extraction of a primary cuspid (Figs. 6, 7). The permanent cuspid of the upper maxilla after touching the lateral incisor moves into a more vertical position and first appears in the oral cavity in a high mesial-directed position but ends its course in the correct space and position.

☐ Premolars initially move buccally but later move in a lingual or palatal direction.

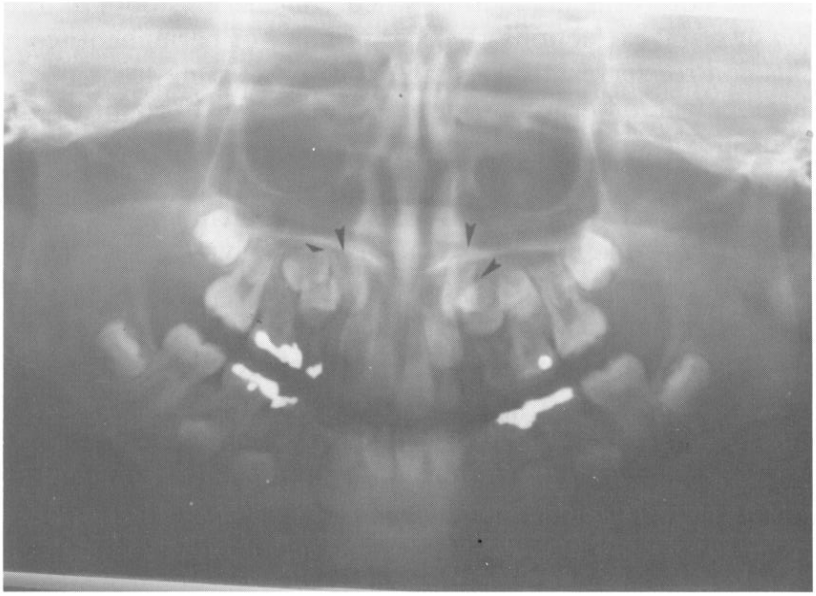

Fig. 6. S.I., boy, eight and one-half years old; permanent cuspids appear to be on the right course and in the correct aisle.

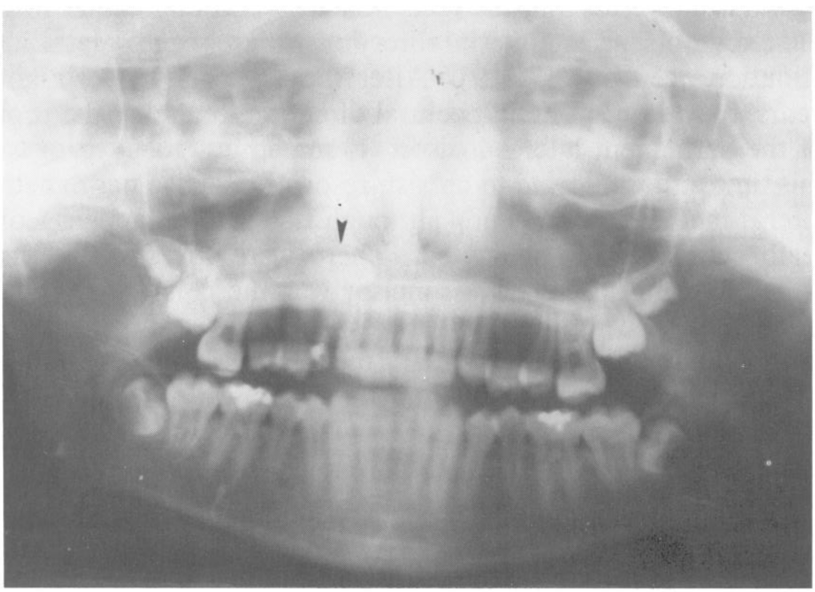

Fig. 7. S.I., boy, thirteen years old, right cuspid, deviated in nasal fossa floor direction, has become impacted and difficult for orthodontic treatment. Retention of the primary canine caused blockage of the aisle of eruption; it should have been extracted at the right moment.

☐ Lower permanent second molars, on the contrary, seem to start from a more distal and lingual position and end in a mesial and vestibular direction, while the exact opposite occurs with the upper molars. The mesio-buccal cusps of lower second molars touch the distal palatal cusps of upper first molars, and these cusps are important in guiding eruption. If something should go wrong at this point, a Sim's [21] buccal cross bite could occur later on.

Types of Curves of Eruption

Curves of eruption occur within aisles, and should any anomaly take place (that cannot be compensated or corrected in time), these curves can become either *open* or *closed.* They can also subsequently alter the curves of neighboring teeth or even the antagonists, producing a set of curves that can be further classified as independent and/or interrupted and/or interlaced.

☐ *Independent curves*—when the opening or closing of the curves of eruption alters the curves of the antagonists.

After appearing in the oral cavity, the antagonists move into an ideal cuspid relationship. According to Poole [14], the cusps serve as guides of eruption. In cases of cross bite, improper intercuspation occurs, but these cases are not included in those of independent curves.

Independent curves of eruptions, as the name indicates, are those where there is no relationship between the cusps: the upper curve moves, for example, in a buccal direction, continuing the curve, while the antagonist moves in a lingual direction, in a Sim's [21] buccal cross bite (Fig. 8).

Sometimes it is not possible to check through radiographic control whether the curves of eruption are or will be independent, except when interlacing occurs (mainly with third molars). Generally speaking, clinical control is the essential way of checking.

☐ *Interrupted curves*—when the opening or closing of the curves of eruption alter the curves of the neighboring teeth and cause them to become impacted, precluding completion of the five stages of eruption, these curves are interrupted by blockage of the aisles of eruption. As soon as the obstruction is removed, complete eruption occurs (Fig. 9).

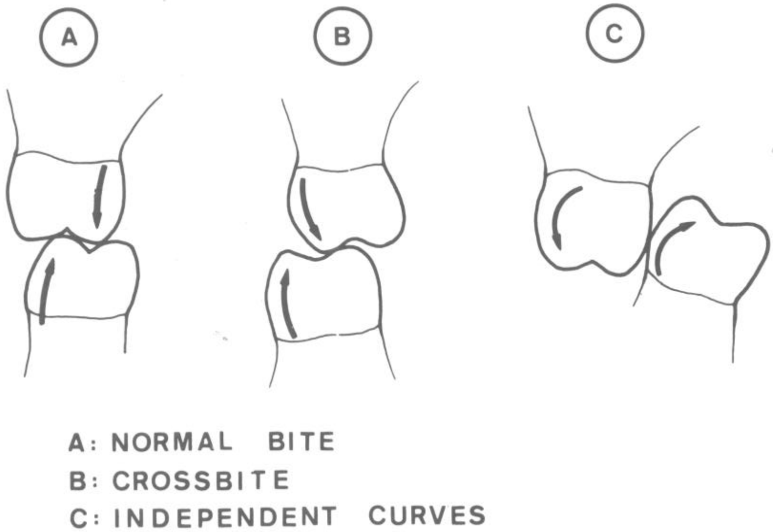

Fig. 8. Independent curves—force, timing and sequence of eruption altered among the antagonists, opening and closing curves, forming independent curves; occurring frequently with second molars, which even reach opposite ridge, provoking serious vicious mastication problems and consequent TMJ dysfunctions. Independent curves can also be caused by the interlacing of the curves of the second molars and the neighboring third molars.

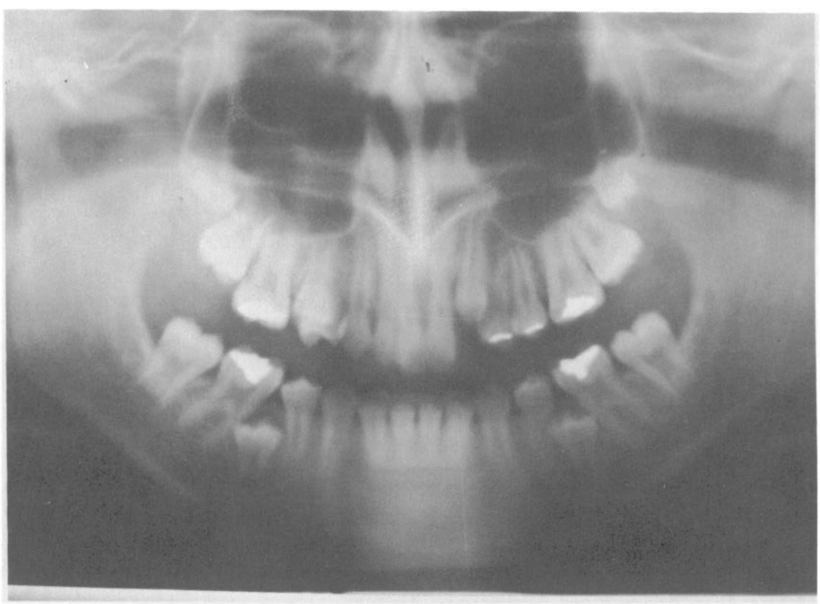

Fig. 9. A.C., girl, twelve years and three months old, interrupted curves of both second lower premolars caused by early extraction of primary second molars.

☐ *Interlaced curves*—when the opening or closing of the curves of eruption alters the curves of neighboring teeth, the aisles become interlaced (Figs. 10-12).

Some Facts About Timing of Eruption

☐ In human beings, teeth erupt at the rate of 1mm per month, while in rats, they erupt at the rate of 1mm per day, with eruption tending to decrease at night (experiments carried out with incisors) [22].

☐ If eruption is delayed and a pulpotomy is performed —with a still not completely formed root—a maximum rate of eruption of 2.2mm per month is obtained, while if the root is already formed, the rate of eruption is only on the order of 0.25mm per month (experiments carried out also with incisors) [23].

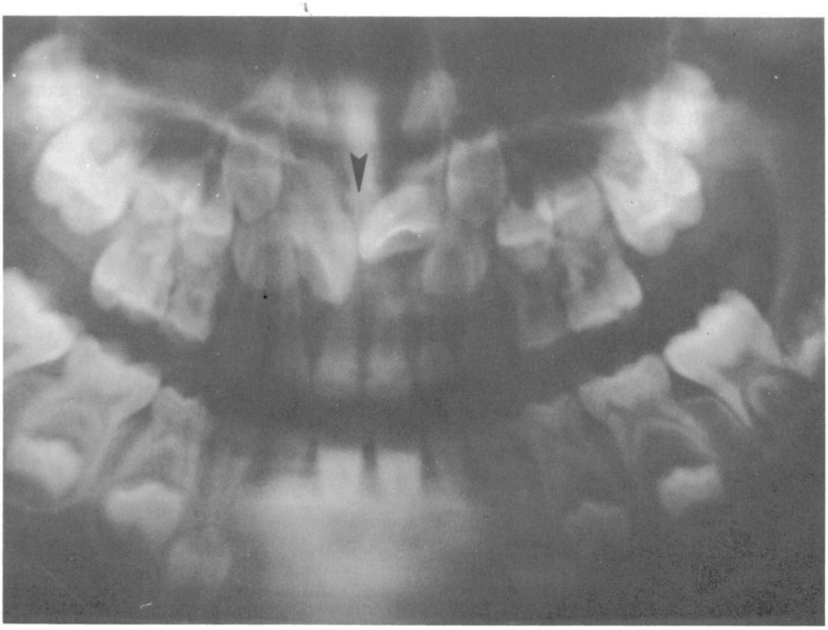

Fig. 10. A.H., girl, seven years old, interlaced curves; upon crossing, they caused an impacted palatal position of the central right incisor. The primary left incisor should have been extracted; and only after the corresponding permanent tooth had erupted should the primary lateral right incisor also have been extracted; finally the primary center right incisor should have been extracted after the successor of the primary lateral right incisor had erupted, forming the other wall of the eruption aisle for the center right or incisor.

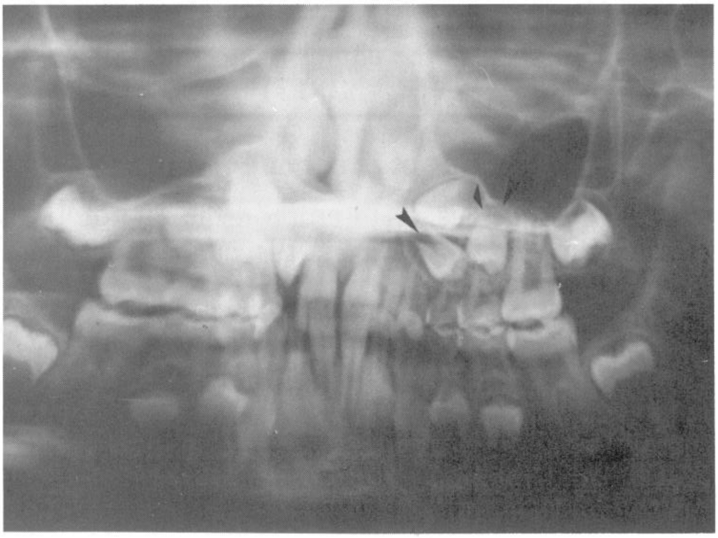

Fig. 11. Interlaced curves—A.P.L., girl, eight years old, curves of eruption crossed between premolars and permanent left canines. The first primary molar was first extracted. After an aisle was formed for the second premolar, between the already-erupted first premolar and the first molar, the second primary molar was extracted. The cuspid was able to follow its normal course, but since it reached the lateral primary tooth late, it was necessary to extract the latter. Functional orthopedic appliances were also used, concomitantly with SE, in this case.

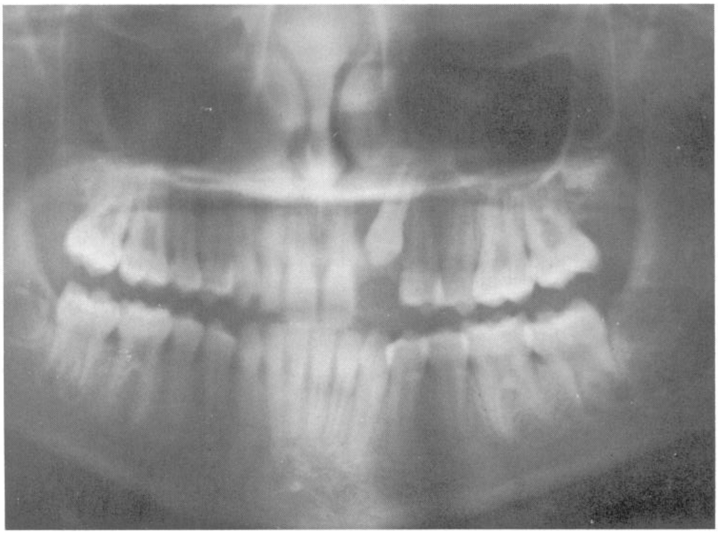

Fig. 12. A.P.L., girl, twelve years and one month old, a case of interlaced curves corrected according to new concepts in SE and providing consecutive eruption aisles.

☐ Alterations in timing of eruption are more closely related to the developmental stage of permanent teeth than to the age of patient. Posterior teeth take from two to five years to appear in the oral cavity and, from then, twelve to twenty months to attain occlusion (i.e., after the crown is completely formed (stage six—Nolla) and the root has begun to form) [19].

☐ More rapid eruption occurs when alveolar processes are destroyed by infection. But if three-fourths of the roots are already formed, eruption will be delayed even if alveolar processes have been destroyed [24, 25].

☐ Crowns of premolars and molars calcify at up to seven to eight years of age, but there have been cases when calcification occurs as late as ten to twelve years of age [26] (Figs. 13, 14). Therefore, these factors should be considered before a decision is made to extract primary molars counting on an assumed absence of premolars.

Any analysis of aisles of eruption should always be done based on thorough knowledge of force, timing, and sequence of eruption.

Proceedings of Analysis of Aisles of Eruption

The analysis consists primarily of determining which permanent tooth, in each aisle, is closest to the alveolar crest and has adequate enough walls to guide the eruption process. If we can observe through radiographic control as well as clinical examination that the sequence, timing, and force of eruption of each tooth is following a harmonious pattern, in function of the human being as a whole and vice versa, then we should not interfere in the process by recommending serial extractions. However, if we should observe a phasic element in time and space, we should recommend that the necessary extraction or serial extractions be done at the right time (Figs. 10-12).

The loss of primary teeth occurs at the cost of resorption of their roots. If this factor causes any trouble, in terms of time, by either provoking premature loss or retention of these dental elements, we must maintain space or carry out extractions.

The following conditions can modify the genetic plan for eruption of permanent teeth: badly made restorations,

Fig. 13. V.A., girl, eight years old, precipitated interpretation of anodontia of second lower premolar.

Fig. 14. V.A., girl, twelve years old, beginning of calcification of second lower premolar.

caries (especially interproximal [27]) in primary teeth, bad habits, occlusal trauma, inflammations, infections, pulpotomies which accelerate permanent tooth eruption and pulpectomies which delay eruption, ankylosis (delays permanent tooth eruption [19, 25]), agenesis (usually when this occurs with primary teeth it will also occur with permanent teeth, although the reciprocal may not always be true), and supernumeraries. Careful observation and follow-up is required in order to correct, if possible, any of the above problems. Unequal resorption of primary roots causes rotations, inclinations, and impacted permanent teeth. If agenesis occurs with a permanent tooth, the primary one usually is retained and root resorption is retarded. Agenesis generally is in a multiple form.

In selecting the sequence for extraction, we must also base our selection on the already-existing extent of calcification of the permanent tooth, if the tooth is slow to erupt, the neighboring wall will also delay in forming and will impair the aisle. Therefore:

(1) We should first extract the primary tooth whose successor is closest to the alveolar crest, regardless of the fact that the problem may be on the curve of some other permanent tooth.
(2) We should wait for the permanent tooth corresponding to the previously extracted primary one to erupt and form a wall to the neighboring aisle of eruption.
(3) We should extract the primary tooth corresponding to what was the second succeeding tooth closest to the alveolar crest which will then also form a wall after erupting.
(4) We should wait for the permanent tooth corresponding to the last primary one extracted to erupt and form another wall to the neighboring aisle of eruption.
(5) We should extract the primary tooth the successor of which presents a problem with its curve but which has now already an aisle of eruption resulting from the previous extractions.

Sometimes the simple extraction of a primary tooth is enough to form an aisle for the permanent tooth which may be having a problem with its curve.

There is no general formula for serial extractions; selection, sequence, and the right time for extraction must be considered on an individual basis, and sound judgment and good common sense are always needed.

Irreparable damage may result if our selection, sequence, and/or timing for serial extraction is wrong; if an insecure diagnosis leads us not to carry out extractions at the right time; or if we fail to take into account the space that the growth potential may eventually provide (guided or not by a well-chosen and well-carried out orthodontic treatment).

Considerations in Serial Extractions

According to new concepts in serial extractions when extracting a tooth or series of teeth, the following considerations should be taken into account:

(1) Type of occlusion;
(2) Influence on incisor impulse of development (IID), development being in the anterior-posterior direction [28];
(3) Stage of development of permanent teeth;
(4) Age of patient; and
(5) Analysis of aisles of eruption:
   (a) Analysis of the permanent tooth about to erupt and its relationship to the alveolar crest with observation of degree of calcification (previously considered under item 3);
   (b) Analysis of the position of neighboring teeth which form the walls for the aisles of eruption for permanent teeth;
   (c) Analysis of position of antagonists; and
   (d) Selection criteria of dental element or elements, time, and sequence for SE.

As extractions are carried out and permanent teeth erupt, we must observe all the teeth individually and also collectively as a group; radiographic control must be done to check correct formation of the aisles.

Thus, based on this new concept of SE, we are considering not just the perimeter of the dental arch but the overall picture of phasic growth which must be turned into a harmonious one, making full use of its potential.

Primary incisors. When a permanent tooth already in the process of erupting or about to erupt is distant from the corresponding primary tooth, extraction of the primary tooth should be delayed until movement of the tongue has brought it in closer. This happens more often with lower primary incisors. The lateral primary incisor should not be extracted in order to make space for a permanent central incisor. Based on new concepts in serial extractions, we only extract the primary tooth the successor of which has already erupted or, in some cases, is about to erupt.

Primary cuspids. These are extracted only under the already-described circumstances (those referring to the course of the curve of eruption of cuspids) or when they are in the way of their successors.

Primary cuspids. These should never be extracted to make space for a lateral incisor, as was recommended under the old concepts of SE, because such extraction creates future problems for the permanent cuspid, in the way of further atrophy and frequently at the risk of later extracting premolars in cases where this is unwarranted.

Primary molars. Under current SE techniques, these are often extracted. We know that if the loss of the first primary molar is before seven years of age, the eruption process is delayed. Before four years of age, a delay of up to one year occurs; while before six years of age, a six-month delay occurs [24]. After seven years of age, loss of the first molar accelerates eruption. There are cases, however, when it should not be extracted—for example, when there is not a permanent successor.

Ankylosis also affects primary molars; actually, it has more effect on primary than permanent dentition and more on lower than upper teeth, generally, affecting both sides [19].

Since ankylosed teeth are those that were in occlusion (at one and a half to two years of age), it is a mistake to call them "submerged" [9]. The sooner a primary tooth becomes ankylosed, the greater the impediment occurs for the permanent tooth to erupt [2, 9, 19]. An ankylosed tooth should be extracted, if necessary, but only at the right moment. In these cases, an evaluation must be done according to the type of occlusion that is occurring. Loss of primary molars or retention beyond the right time has a strong influence on incisive impluse of development.

Any primary tooth that is infected and cannot be suitably treated and is causing general or local problems should be extracted. Those whose successors are already erupting or erupting outside of the correct course should also be extracted. Primary molars when infected are the teeth that cause most trouble for their successors. Depending on the area infected, if no greater problems arise and if it is convenient to the type of occlusion occurring, the molars are preserved in order to maintain IID. When convenient, we extract the lower molars —even if they are not infected—in order to avoid an increase in stimulus of mandibular growth. These are the exceptional Class III or Class III tendency cases with structural open bite where, as the individual grows, the separation between the maxilla increases through the posterior rotation of the mandible. This situation becomes further aggravated if the mandible advances out of physiological control.

Our experience shows that early extraction of lower primary molars (after careful study of aisles of eruption in order to select teeth for extraction) breaks the neural tooth-to-tooth circuit on the same arch which stimulates IID. We are then able to control the Class III tendency as well as the growth rate of the mandible, but we do not directly influence the open bite. SE is only part of the orthodontic and sometimes even surgical treatment that will be necessary in the future.

SE of primary molars, in order to improve the type of malocclusion occurring, is used in only very special and extreme cases, those that nearly always later call for extraction of permanent molars as well. At this time, we will be acting directly on the open bite.

It is also evident that SE of upper primary molars in Class II cases does not produce the same results because the sensory mechanism (to the stimuli) changes in view of the different vascular-nervous anatomy of the mandible. Besides this, variations may occur from case to case, and these must be individually considered.

Primary molars are also extracted when they are affecting the curves of the lower premolars, usually lingual, or the upper premolars, usually buccal or palatal.

Infection of a primary tooth—especially a molar—occuring in a large enough area and for a sufficient amount of time can cause the curve of eruption of the corresponding permanent tooth to turn or change direction completely and/ or even affect curves of neighboring teeth.

In cases of overbite, independent of Angle's classification, molars should never be extracted because the overbite would only become more accentuated. To confirm this, we have only to observe those cases where loss of molars was inevitable. In cases of open bite, even permanent molars can be extracted, because their eruption provokes posterior rotations of the mandible.

Primary molars should not be extracted only to provide space for permanent first molars—we would then lose space for the second premolar which would not have an aisle and would have its curve interrupted by the eruption of the first molar in its place. The problem would become further aggravated when the second molar would erupt. It is more problematic to create than to maintain space.

Permanent incisors and cuspids. Permanent cuspids are never extracted, and extraction of incisors is only very rarely done. Cuspids serve as guides for mandibular movements and are the only ones on each side. Pedro Planas suggests that further study should be made on the neurophysiology of canines because perhaps they contain aspects of another law of development of the maxilla (personal communication).

Premolars. Primary molars as well as premolars should be extracted when such cases are diagnosed as genuine biprotrusion, accentuated mesial tendency, and low basal bone.

Premolars can also be extracted, in those rare cases of delayed orthodontic treatments already into adolescence, when the number and size of teeth do not correspond to the perimeter of the arch in perfect alignment, although growth potential should be very carefully evaluated.

Extraction of the first premolar reflects more on anterior teeth, while extraction of the second premolar affects posterior ones which then move in a mesial direction. The decision as to which and how many teeth should be extracted will also depend on the size of the crown and type of occlusion occurring as well as the existence or not of asymmetrical growth and correction possibilities.

Permanent molars. Permanent molars should not be extracted except in certain cases with structural open bite or tendency for open bite.

When there is severe and early open bite, the eruption of the second molar could result in a condition that would further accentuate the open bite. In this case, it seems that the most convenient time to extract molars would be after the premolars have erupted or at least when their aisles are ready to conduct them to correct eruption.

Second molars can be safely extracted according to conditions suggested by Mollin [29]:

(1) The third molar should not have any roots or maximum one-third of roots formed only.
(2) The patient should be approximately fifteen to sixteen years old.
(3) An open bite should exist (actually this should be the main reason for extraction).
(4) The crown of the third molar should be the right size to be able to substitute for the second molar.
(5) The third molar should be in a mesial direction.

Actually, in all those cases where second molars were extracted (some patients not yet fifteen years old), third molars took the place of second molars and the open bite closed satisfactorily.

Conclusions

The loss of a tooth is sufficient to change neuromuscular reflexes as well as mastication. It consequently plays an important part in the development of the maxilla [28].

Serial extractions can be a decisive influence in the development of maxilla; thus, critical judgment and selection criteria for SE must be applied, foreseeing the harmonious growth as a whole as well as the growth of parts on a long-term basis.

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