

Managing the Developing Occlusion

A guide for dental practitioners



IBOS

INTRODUCTION

Whether knowingly or not, every dentist who treats children practices orthodontics. It is not enough to think of orthodontics as being solely concerned with appliances. Orthodontics is the longitudinal care of the developing occlusion and any problems associated with it. All qualified dental practitioners should be encouraged to consider the orthodontic requirements of their patients.

This booklet is designed to help general dental practitioners examine children from an orthodontic viewpoint. It will highlight the assessment of patients at different stages of dental development and will outline the interceptive procedures and treatments available to deal with the conditions most commonly encountered.

Before specific assessment and treatments are considered, a general view of the developing dentition and face is advisable. This should rely on common sense as well as experience and ability.

ORTHODONTIC ADVICE

First, when considering potential orthodontic advice for the patient, the dental practitioner should consider the following general questions:

1. Is the patient's basic dental health under control and is the parent available for consultation?
2. Is the orthodontic condition minor, moderate or severe in nature and does it cause the patient concern?
3. Can the practitioner provide adequate advice in the short, medium and long term, or is specialist advice required and, if so, at what level?
4. Would the patient and parent prefer a specialist opinion?

TREATMENT

Secondly, when considering potential orthodontic treatment for patients, the dental practitioner should consider the following general questions:

1. Does the patient want the condition changed?
2. Is the patient receptive to the idea of, and available for, orthodontic treatment?
3. Is specialist treatment required and, if so, at what level?

ADVICE

Following these general questions, the newly qualified dental practitioner may feel that further advice is required. This may be available from the following sources:

1. *The Dental Practice Principal*

The principal may have a particular interest in orthodontic therapy or, failing this, should be able to advise on the orthodontic facilities that are available in the local area.

2. *An Orthodontic Specialist Practitioner*

Orthodontic specialists in practice have usually undergone a formal postgraduate course of training leading to a higher qualification in orthodontics (M.Orth or D.Orth). The primary function of a specialist is to offer treatment but advice will also be available for general dental practitioners.

3. A Community Orthodontist

Community orthodontists have undergone a formal postgraduate course of training leading to a higher qualification in orthodontics (M.Orth or D.Orth). Community orthodontists are salaried specialists who work in the community dental clinics and, in some districts, only treat community service patients. In other districts, referral for treatment from general dental practitioners are accepted. Again, the emphasis is likely to be on the provision of treatment rather than delegated treatment planning.

4. A Consultant Orthodontist

Consultant orthodontists have completed a formal course of training leading to a higher qualification in orthodontics (M.Orth or D.Orth) and have also undergone an additional period of higher specialist training. Consultant orthodontists are trained to provide a full diagnostic, treatment planning and advice service for general dental practitioners. Hospital consultant orthodontists are likely to limit the type of treatment available in their departments to patients with more severe orthodontic problems. As a result, they may delegate suitable treatment plans to any of the above mentioned colleagues.

REFERRAL LETTERS

The preferred method of communication between practitioner and orthodontic specialist is by referral letter or a specific proforma. Many PCTs/LHBs have brought in their own standardised referral proforma which all local practitioners are required to use. This letter should include the following basic information:

1. Patient's full name; surname and first names. Which is which should be clearly identified.

2. Patient's address including the postcode. The postcode identifies patients who cross district health boundaries for treatment. This enables the provider unit to be reimbursed by the Primary Care Trust or Local Health Board in which the patient is resident. Most patient administration systems (PAS) will not accept a referral without the postcode.

3. Patient's date of birth.

4. Patient's telephone number. This will enable the specialist to contact the patient at short notice.

5. Patient's general medical practitioner. This information is needed to register the patient in the case of hospital referrals - again a PAS requirement.

6. Any reference (coded at the top of letter) from previous correspondence. This immediately identifies the patient as having had a previous assessment and ensures their notes are retrieved rapidly and the appropriate action taken.

7. The letter should contain the specific reason for the referral. A concise and relevant medical, dental and social history should be included along with the patient's main cause for concern and their likely co-operation with an anticipated treatment plan and orthodontic appliances.

8. Ideally, the patient should be dentally fit and caries-free with excellent oral hygiene and periodontal condition. This is a basic requirement that should be met before an orthodontic referral is made. However, on occasions, early advice can be sought first from an orthodontic specialist regarding the likely need for extractions in patients with carious teeth of dubious long-term prognosis. In addition, any recent radiographs of the patient (e.g. bitewings, periapicals, OPT) that pertain to the reason for referral should be sent along with the referral letter.

9. A copy of the referral letter should be kept in the patient's notes.

It is worth emphasising to the patient and parent that the orthodontic specialist will only provide an assessment at the first appointment. Many patients expect more!

Dentistry is a small profession and practitioners can sometimes become isolated. It is both professional and sociable for new practitioners to introduce themselves to the orthodontic specialists in the local area and vice versa.

This will enable a discussion to take place on the services available and to clarify such points as the range of treatments available, costs and relevant waiting lists. Many areas are developing Managed Clinical Networks (MCNs) locally to ensure good communication between all orthodontic providers and their referring practitioners.

With this information you should be able to refer patients to the appropriate specialist with some idea of what to expect. Communication is enhanced if the practitioner and orthodontic specialist have been previously acquainted.

MANAGING THE DEVELOPING OCCLUSION

1 DECIDUOUS TO MIXED DENTITION

The general dental practitioner is responsible for recognising any deviations from normal in the dental development of his/her child patient. The recognition of abnormality is the first important stage in providing treatment to rectify the situation and requires an understanding of normal dental development.

Spacing is normal between the anterior teeth in the deciduous dentition. These spaces occur most frequently mesial to the upper canine and distal to the lower canine, the so-called primate spaces. Generalised anterior spacing can be present from the time of eruption of the deciduous teeth, but tends to increase with growth of the alveolus. Lack of spacing in the deciduous dentition may be a cause for concern, since crowding of the permanent dentition is a likely sequel.

The deciduous dentition is a time for observation. Characteristics of the deciduous dentition are reproduced or amplified in the permanent dentition. Small overjets become larger whilst reverse overjets and cross-bites invariably reappear in the permanent dentition. However, it is very seldom that any active treatment is indicated for a child in the deciduous dentition.

Supernumerary teeth occur in the deciduous dentition but nearly always erupt and require no intervention. They are followed by extra teeth in the same location in the permanent dentition in 35 - 50% of cases.

THE TRANSITION FROM DECIDUOUS TO MIXED DENTITION

The transition from the deciduous to the mixed dentition begins at around the age of six with the eruption of the lower central incisors (Table 1).

1. A supplemental *B* in the deciduous dentition is to be succeeded by a supplemental *2*.



NORMAL ERUPTION SEQUENCE

		Ages									
		6		7		8		11		12	
		1	1	1	1	2	2	3	3	3	3
		6	6	2	2			4	4	5	5
		6	6					4	4	5	5
										7	7
										7	7

TABLE 1. Transition from the deciduous to mixed dentition begins around the age of six years with the eruption of the lower central incisors.

The permanent teeth erupt in groups with two main periods of activity. The first occurs between the dental ages of 6 and 8 years when the permanent incisors and first permanent molars erupt; the second between the ages 11 and 12 when permanent canines, premolars and second molars erupt. It should be remembered, however, that the dental age of a patient may differ quite widely from their chronological age and a generalised delay in eruption may be of no consequence. A change in the sequence of eruption or an asymmetrical eruption pattern may indicate a possible abnormality and should be investigated further both clinically and radiographically.

Of the first group of permanent teeth to erupt, the most likely to go astray is the upper central incisor. The permanent incisors and canines are usually larger than the corresponding deciduous teeth, whereas the premolars are smaller (leeway space). The combined mesio-distal widths of the upper permanent teeth are about 3mm greater than the deciduous teeth; the lower permanent teeth are about 1 mm larger than their deciduous predecessors.

The extra size of the permanent teeth is accommodated in three ways:

- i) Spacing of the deciduous dentition.
- ii) Growth of the alveolus.
- iii) The eruptive path of the upper incisors.

The increase in width of the dental arches occurs predominantly in two phases, the first being at the stage of eruption of the permanent incisors and then later with the eruption of the permanent canines. The upper incisors erupt into a slightly

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more proclined (forward) position than their deciduous counterparts. This is responsible for some of the increase in dental arch length.

Delayed eruption of one or more of the incisors may lead to space loss. In the presence of crowding, the adjacent teeth tend to drift into the space required for the unerupted teeth.

In the majority of children, the permanent incisors erupt into mildly crowded positions and anxious parents first become aware of crooked teeth. Their alignment frequently improves with subsequent alveolar growth. Reassurance may be all that is required at this stage.

There are other aspects of normal development that can occur in some individuals:

- i) More severe lower incisor imbrication may improve following the exfoliation of the deciduous canines (see later); in most cases it is too early to consider the extraction of deciduous canines.
- ii) The "Ugly Duckling" stage: described as "a fanning out of the crowns of the upper permanent incisors, particularly the lateral incisors, sometimes with a median diastema". It is caused by the position and convergence of their roots prior to the eruption of the permanent canines. The spacing usually closes spontaneously following eruption of the canines.

It is important for the general dental practitioner to recognise these characteristics of normal development so that the patient and their parents can be reassured.

It is important to differentiate between a median diastema associated with the "ugly duckling" stage and other possible causes of median diastema (listed below). These may prompt further investigations:

- i) Family/racial characteristic
- ii) Unerupted supernumeraries
- iii) Basal narrowness of maxilla
- iv) Small teeth, large jaws
- v) Developmentally (congenitally) missing 2|2
- vi) Misplaced 2|2 due to crowding
- vii) Peg-shaped 2|2
- viii) Proclination of 21|12
- ix) Abnormal fraenum



2. An asymmetrical eruption pattern should prompt further investigations. An occlusal or periapical X-ray of BA| will usually indicate the reason for the delayed eruption of 21|.



3. Failure of eruption can be due to a number of causes. The most common is the presence of an unerupted supernumerary tooth. These are not always easily visible on radiographs.



4 & 5. In the presence of crowding, delayed eruption results in space loss. Although CA|AC have been removed, together with the unerupted supernumeraries related to 1|1, these teeth are unlikely to erupt until space has been regained with appliance therapy.



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An early orthodontic assessment, around the period of eruption of the permanent incisors, is a useful exercise as a number of simple interceptive measures are available to the orthodontist, which could significantly reduce the later complexity of many developing malocclusions. A radiographic examination may be considered if the occlusion appears not to be developing normally.

Early orthodontic assessment is used to monitor:

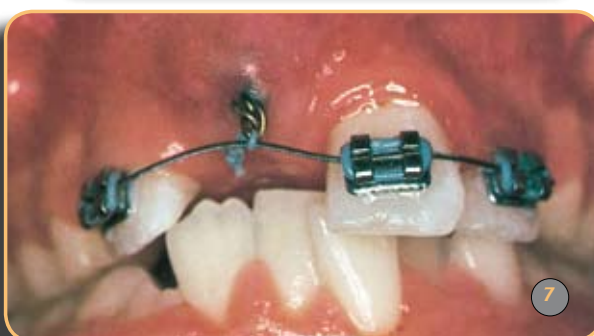
1. Normal eruption of permanent incisors and first permanent molars and to investigate causes of failure of eruption. A tooth will normally erupt within six months of its contra-lateral number.
2. Presence of malocclusion
 - i) Crowding of incisors
 - ii) Significant displacement of incisors labially or lingually (incisors inside the bite)
 - iii) Posterior crossbites
 - iv) Coincidence of upper and lower centre lines
 - v) Severe skeletal discrepancies – especially Class II cases; these may be suitable for functional appliance treatment in the late mixed or early permanent dentition.
3. Long term prognosis of first permanent molars
4. Trauma to permanent incisors
5. Persistent thumb or finger sucking habits

The occlusion is in a relatively dynamic state throughout the mixed dentition. Premature loss of deciduous teeth may cause shifts of centre lines and molar relationships, which are responsible for the development of many localised problems.

6. The non-vital A has been retained, 2 has erupted in advance of 1 and space has been lost. The extraction of A alone will not rectify the situation.

1. Investigate causes of delayed eruption e.g. supernumerary and remedy, i.e. remove.
2. Recreate space for 1.

7. Surgical exposure in combination with the placing of an orthodontic bracket and traction may be needed to encourage some less favourable teeth to erupt.



The plasticity of the occlusion can, however, be used to our advantage. Centre line shifts, caused by deciduous tooth loss, can be corrected by the extraction of the contra-lateral deciduous tooth. Indeed, most of the available interceptive measures rely on space availability and drifting.

The aim at this stage of dental development, around the age of 8 ½ years, is to achieve the complete eruption of upper and lower permanent incisors, in reasonable alignment, with coincident centre lines.

Further details on the management of unerupted upper incisors are available in the form of published national clinical guidelines on the Faculty of Dental Surgery (Eng.) website at: www.rcseng.ac.uk/fds/clinical_guidelines.

POSSIBLE INTERCEPTIVE MEASURES

Interceptive treatment is often the first stage of a more complex treatment plan. The aim is to aid the development of an ideal occlusion and minimise any deviation from normal. Inappropriate intervention may, in fact, complicate matters, especially if excessive space loss has been allowed to occur. If in any doubt, seek further advice.

1. Extract deciduous teeth displacing their permanent successors.
2. Balance the loss of one deciduous canine with the extraction of the contra-lateral tooth to prevent the centre line shifting to the side of the missing tooth.
3. Observe the effects on centre lines of the loss of first deciduous molars. Consider extracting the contra-lateral deciduous canine if this occurs.
4. Appliances to discourage thumb sucking at this stage are found to be less valuable than gentle dissuasion, encouragement and advice.

POSSIBLE TREATMENT MEASURES

1. Surgical removal of supernumerary teeth related to unerupted incisors. Refer to an orthodontist for assessment of eruption sequence and space availability.
2. Appliance therapy to correct:
 - i) incisors in crossbite
 - ii) unilateral buccal crossbite causing displacement
 - iii) to recreate space for unerupted incisors.
3. Space maintainers at this stage are seldom indicated. **The best space maintainer is the patient's own deciduous dentition!** Upper second deciduous molars should be preserved, whenever possible, to prevent mesial movement of 66 and loss of arch length.

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WHAT TO REFER FOR SPECIALIST ADVICE OR TREATMENT

The types of problems that specialists would prefer to see early (*i.e.* at 7-9 years of age), rather than late, are listed below:

1. Delayed eruption of permanent incisors, whether or not related to supernumerary teeth. Always refer to an orthodontic professional.
2. Supplemental incisors - if you are unsure which tooth to extract.
3. Developmental (congenital) absence: commonly affects lower central and upper lateral incisors and second premolars. Consideration must be given to the eventual position of the upper canines, if lateral incisors are absent.
4. One or more upper incisors in crossbite. This may indicate a developing Class III jaw relationship which would benefit from early orthopaedic treatment.
5. Impaction or failure of complete eruption of one or more first permanent molars.
6. Severe crowding.
7. Severe skeletal discrepancies - especially Class II (small lower jaw) and Class III (small upper jaw) children.

2 LATE MIXED DENTITION

As discussed on page 4, the permanent teeth erupt in groups with two main periods of activity. The second phase occurs between ages 11 and 12 when the canines, premolars and second molars erupt. This second period of eruptive activity provides another opportunity for taking interceptive measures designed to reduce the severity of a developing malocclusion.

THE NORMAL TRANSITION FROM MIXED TO PERMANENT DENTITION

In contrast to the anterior teeth, the premolars are smaller than their deciduous predecessors. The resultant leeway space of about 2.5mm on each side of the lower arch and 1.5mm in the upper arch, is usually spontaneously taken up by the forward movement (mesial drift) of the first permanent molars.

The deciduous molars normally meet cusp-to-cusp. Greater forward movement of the lower first permanent molar and differential mandibular growth in this period result in the development of the Class I molar occlusion of the permanent dentition.

The late mixed dentition is characterised by the eruption of two further groups of teeth as illustrated in the eruption chart (Table 1- page 4). The lower canines and upper and lower first premolars all erupt more or less together at a dental age of 11 years. Dental age and chronological age correlate only moderately well and greater attention should



8, 9 & 10. Retained or submerged deciduous teeth, severe crowding and teeth of abnormal form, may prompt referral for specialist advice.

be taken of the sequence of eruption as opposed to the timing. It is useful to remember when assessing dental age and development that permanent teeth usually erupt when three-quarters of their roots are complete.

VARIATIONS FROM NORMAL DEVELOPMENT

Crowding is the most common cause of variation from the norm. It often first manifests itself with the eruption of the incisors. The upper central incisors frequently erupt normally, leaving insufficient space for the lateral incisors, which subsequently erupt in displaced positions. They may be displaced palatally, so reflecting their developmental positions, or labially or rotated within the line of the dental arch.

The last tooth of a group of teeth to erupt is often the one most affected by crowding. Consequently, in the late mixed dentition, the permanent canines or second premolars are the most frequently affected teeth. These teeth may be displaced palatally or buccally or simply fail to erupt altogether due to a shortage of space and subsequent impaction.

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11. Retained, non-vital deciduous teeth frequently cause their permanent successors to be displaced.



12. The favourable unerupted canine can usually be seen or palpated buccally.



13. The assessment of unerupted canines can be difficult. Seek further advice as necessary.



14. Do not leave it this late! The attrition to $\lfloor C$ and the over eruption of $\lceil 3$, together with the lack of space for the unerupted $\lfloor 3$ make this a difficult problem to correct. The appearance of the retained deciduous tooth, its root morphology and its occlusion with opposing teeth, all require regular assessment at dental check-up appointments.

OTHER CAUSES OF DELAYED ERUPTION OF PERMANENT TEETH

1. Abnormal developmental position
2. Presence of supernumerary teeth or odontomes
3. Trauma to deciduous teeth causing:
 - i) Ankylosis
 - ii) Displacement of permanent teeth
 - iii) Dilaceration
4. Retained deciduous teeth
5. Impaction
6. Eruption cysts

THE ECTOPIC PERMANENT CANINE

Of the group of permanent teeth erupting during the late mixed dentition stage, the upper permanent canine is the most likely to stray from its normal eruptive path. The incidence of an ectopic maxillary canine is 1 - 2% of the population. Of these, 85% are displaced palatally.

If ectopic eruption is suspected, early localisation using clinical (palpation) and radiographic methods is recommended so that interceptive measures to encourage eruption can be instituted as soon as possible. Should these fail, time must be available for alternative treatment options. The later an ectopic canine is spotted, the less likely it is that treatment will be successfully completed.

Parallax technique

Two radiographs taken with a shift in the cone position between the two views *i.e.* OPG and upper anterior occlusal (vertical parallax) or two periapical views (horizontal parallax). As the cone shifts between the two views, the ectopic tooth will change its position in relation to the adjacent teeth. If the ectopic tooth moves in the same direction as the tube shift, then the tooth is palatally displaced.

It is important to assess the position of the unerupted canine early (before 11 years of age), since the simple extraction of the deciduous canine tooth may result in a significant spontaneous improvement in the position of the majority of palatally displaced canines. Fortunately, ectopically displaced canines are frequently unilateral, resulting in an identifiable asymmetry on manual palpation. The favourable canine is usually palpable buccal to the resorbing deciduous tooth by the age of 10 – 11. The angulation of the crowns of the adjacent teeth (especially the lateral incisor) also helps to localise the unerupted canine.

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The incidence of ectopic maxillary canines increases markedly in the presence of any abnormality of the lateral incisor. 5% of ectopic canines are associated with an absent lateral incisor, whereas 11.5% are associated with a peg-shaped tooth.

48% of palatally displaced canines are related to anomalous lateral incisors.

Clinical and radiographic indications for intervention include:

- i) Permanent canine not palpable in labial sulcus by age 10.
- ii) Deciduous canine root resorption not progressing.
- iii) Radiographs indicate ectopic position or damage to adjacent teeth.
- iv) Canine crown overlaps the most distal incisor root.
- v) Enlargement of canine follicle.

If you suspect an ectopic canine, refer to an appropriate orthodontic professional. Published national clinical guidelines on this topic are available from the Faculty of Dental Surgery (Eng.) website at: www.rcseng.ac.uk/fds/clinical_guidelines.

THE RESULTS OF EARLY LOSS OF DECIDUOUS TEETH

Space loss resulting from the early extraction of deciduous teeth is usually attributed to mesial drift of the molars. However, in the canine region, it can also be due to distal drift of anterior teeth. Most space loss occurs after extraction of the deciduous teeth, markedly so in the case of second deciduous molars.

The consequences of early loss are summarised below:

1. In cases where crowding is absent, early loss of deciduous teeth will have little or no effect on the permanent dentition.
2. Where crowding is present:
 - i) Space loss is always greater in the upper arch than the lower.
 - ii) Loss of second deciduous molars leads to a greater loss of space than loss of the first deciduous molars.
 - iii) Very early loss of second deciduous molars, before the eruption of the first permanent molars, can lead to almost complete loss of the second premolar space.
 - iv) Extractions after the age of 10 can cause relatively little space loss.

- v) Unilateral extraction of Cs and Ds is likely to cause a shift of the centre line; this tendency is greater in the lower arch than the upper.

The loss of a deciduous canine on one side should be balanced by the extraction of the contra-lateral tooth, so as:

- i) to prevent centre line shifts and
- ii) to allow spontaneous alignment of the incisors.

There is no justification for balancing the extraction of second deciduous molars when one or more have to be lost. This would lead to space being lost in the buccal segments to no advantage.

POOR QUALITY FIRST PERMANENT MOLARS

The first permanent molar continues to be the most caries prone member of the permanent dentition. Its early loss or poor long-term prognosis frequently complicates orthodontic treatment planning.



15. Early loss of second deciduous molars has resulted in severe space loss. First molars have tilted mesially. Although past the optimum age for extraction of first molars, their loss, due to poor quality, will provide the space where it is needed.



16. When assessing the prognosis of first permanent molars, remember to also look at the buccal surfaces of upper and the lingual surfaces of lower molars, which are caries prone areas.

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17 & 18. EXTRACTION OF DECIDUOUS CANINES.
Age 8 years 6 months. Lower 212 erupted and rotated.
212 unerupted and short of space. All deciduous canines extracted.



19 & 20. EXTRACTION OF DECIDUOUS CANINES.
Age 9 years 6 months. Incisor alignment much improved one year later.



If more than one of the first permanent molars has a doubtful prognosis, then extraction of all four first molars may be indicated. Optimal space closure occurs when the timing of these extractions is carefully managed and the advice of a specialist should be sought. The best results are achieved if the following combination of factors co-exists at the time of extractions:

1. **CHRONOLOGICAL AGE.** Best results are achieved at around the age of 9 and 10 years.
2. **DENTAL AGE.** Lateral incisors and first premolars should have erupted but not the remaining buccal teeth. Calcification of the bifurcation of the roots of the second permanent molars should have just commenced.
3. Radiographic examination must be carried out to confirm the presence of successional teeth.
4. Crowding should be present. Ideally, the crowding should be located in the buccal segments, as the extraction of first molars does little to relieve anterior crowding.

As active orthodontic treatment is required to relieve anterior crowding or reduce an increased overjet, it may be better to retain the upper first molars until the start of active treatment so that no useful space is lost. Where the extraction of a single first permanent molar has been necessary, advice regarding the status of the remaining first molars should be sought.

Further information on this topic is available from the National Clinical Guidelines section of the Faculty of Dental Surgery (Eng.) website at: www.rcseng.ac.uk/fds/clinical_guidelines.

THE EXTRACTION OF ALL DECIDUOUS CANINES

It is not uncommon to extract all four deciduous canines in the following circumstances:

1. To provide space so that a crowded but unerupted maxillary lateral incisor may erupt without being deflected into lingual occlusion. Once a positive overbite has been obtained, such teeth will not correct spontaneously even when space is made available. Early intervention is therefore crucial.
2. To provide space for crowded maxillary incisors, which are already in lingual occlusion, to be corrected in the early mixed dentition.
3. To provide space for severely crowded lower incisors to align spontaneously - if the crowding is more of a displacement than a rotation, and the lateral incisors are less than half erupted.
4. To ensure that incisors delayed by the presence

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of a supernumerary tooth have sufficient space to allow their full eruption.

5. To encourage a palatally ectopic maxillary canine to erupt.

SERIAL EXTRACTION

The full serial extraction procedure is seldom recommended these days since the prospect of having 12 teeth extracted must be daunting to any child.

However, all first premolars can be extracted as the permanent canines emerge in order to provide sufficient space for them to erupt in the line of the arch. It is particularly important to check that the upper canines are favourably placed (*i.e.* mesially inclined and buccally positioned). The premolars should not be extracted too early as undue space loss may occur.

“*Driftodontics*” is the term used to describe the judiciously timed removal of teeth to enable some spontaneous improvement in the eruption and alignment of the permanent dentition to occur. It may avoid, minimize or simplify the need for future active orthodontic treatment. In some crowded Class I cases, it may be prudent to extract the fully erupted first premolars to allow sufficient space for the canines and second premolars to erupt into the line of the arch. Always seek orthodontic advice first before proceeding.

GENERAL ANAESTHETICS

The extraction of deciduous teeth for orthodontic purposes seldom justifies a general anaesthetic (Poswillo recommendations). If a child will not accept extractions under local anaesthetic, they should be referred for a specialist paediatric dental opinion. It may be better to avoid extractions rather than expose the child to the risk of a general anaesthetic.

POSSIBLE INTERCEPTIVE MEASURES

The permanent teeth erupt into a dynamic and changing environment. During the period of eruption, changes occur as a result of skeletal growth, premature tooth contacts, sucking habits and soft tissue adaptations. It may be possible to influence some of these factors by interceptive measures.

Remember to confirm the presence of all permanent teeth before any extractions are carried out.



21. EXTRACTION OF DECIDUOUS CANINES.

Age 10 years 6 months. Incisors well aligned and crowding transferred to the buccal segments. This patient will probably require orthodontic therapy and permanent extractions in due course.

1. Extraction of deciduous teeth.
 - i) To relieve significant incisor crowding.
 - ii) To prevent or improve centre line problems.
 - iii) If the permanent successor is being displaced.
2. Active treatment
 - i) To correct incisors in crossbite.
 - ii) Early correction of buccal crossbite.

WHAT TO REFER FOR SPECIALIST ADVICE OR TREATMENT

There are numerous anomalies occurring in the mixed dentition, which should be referred early (*i.e.* at 7-9 years of age) for specialist advice. These include the following:

1. Severe skeletal problems where early treatment may be appropriate - particularly developing Class III (small upper jaw) children.
2. Unfavourably positioned canines or other teeth.
3. Developmentally missing (congenitally absent) permanent teeth.
4. Poor quality first permanent molars or other teeth of poor prognosis where timing of extractions may simplify subsequent treatment.

The Index of Orthodontic Treatment Need (IOTN) is an internationally used measure to assess the need and eligibility of patients for NHS orthodontic treatment. There are two components to this index:

- i) Dental Health Component (DHC) grades 1 to 5 – see Table 2
- ii) Aesthetic Component (AC) - graded 1 to 10.

The Aesthetic Component is a scale of 10 colour photographs showing different levels of dental attractiveness. The general dental practitioner should choose one of the photographs which he or she feels best grades (matches) the malocclusion of the child being assessed. It can also be used as a counselling tool with patients with mild problems to see where

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they think they fit on the scale.

Currently, to be eligible for NHS treatment a patient must score a minimum DHC score of 3 along with an AC grading of 6 or above.

3 EARLY PERMANENT DENTITION

The early permanent dentition is the best time to carry out treatment for the majority of patients. There are obvious social advantages at this age. The alveolar bone is readily remodeled during periods of active growth. This facilitates the tooth movements produced by orthodontic appliances. This is the ideal time for a full orthodontic assessment to be carried out in order to determine whether active orthodontic treatment is indicated.

TABLE 2.
The Dental Health Component of the Index of Orthodontic Treatment Need

ORTHODONTIC ASSESSMENT

Severe malocclusions are obvious even to the untrained eye. Less severe problems may not be so readily apparent, but they may be just as difficult to treat.

A system for the clinical assessment of malocclusion needs to be simple yet methodical to ensure that all abnormalities are noted.

The following sequential examination is recommended:

1. Lower labial segment - check for alignment and crowding.
2. Upper labial segment. Note the presence and position of all anterior teeth and the inclination of the incisors.

GRADE 5 (Need treatment)

- 5.i Impeded eruption of teeth (except for third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth and any pathological cause.
- 5.h Extensive hypodontia with restorative implications (more than 1 tooth missing in any quadrant) requiring pre-restorative orthodontics.
- 5.a Increased overjet greater than 9mm.
- 5.m Reverse overjet greater than 3.5mm with reported masticatory and speech difficulties.
- 5.p Defects of cleft lip and palate and other craniofacial anomalies.
- 5.s Submerged deciduous teeth.

GRADE 4 (Need treatment)

- 4.h Less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for a prosthesis.
- 4.a Increased overjet greater than 6mm but less than or equal to 9mm.
- 4.b Reverse overjet greater than 3.5mm with no masticatory or speech difficulties.
- 4.m Reverse overjet greater than 1 mm but less than 3.5mm with recorded masticatory and speech difficulties.
- 4.c Anterior or posterior crossbites with greater than 2mm discrepancy between retruded contact position and intercuspal position.
- 4.l Posterior lingual crossbite with no functional occlusal contact in one or both buccal segments.
- 4.d Severe contact point displacements greater than 4mm.
- 4.e Extreme lateral or anterior open bites greater than 4mm.
- 4.f Increased and complete overbite with gingival or palatal trauma.
- 4.t Partially erupted teeth, tipped and impacted against adjacent teeth.
- 4.x Presence of supernumerary teeth.

GRADE 3 (Borderline need)

- 3.a Increased overjet greater than 3.5mm but less than or equal to 6mm with incompetent lips.
- 3.b Reverse overjet greater than 1 mm but less than or equal to 3.5mm.
- 3.c Anterior or posterior crossbites with greater than 1 mm but less than or equal to 2mm discrepancy between retruded contact position and intercuspal position.
- 3.d Contact point displacements greater than 2mm but less than or equal to 4mm.
- 3.e Lateral or anterior open bite greater than 2mm but less than or equal to 4mm.
- 3.f Deep overbite complete on gingival or palatal tissues but no trauma.

GRADE 2 (Little)

- 2.a Increased overjet greater than 3.5mm but less than or equal to 6mm with competent lips.
- 2.b Reverse overjet greater than 0mm but less than or equal to 1mm.
- 2.c Anterior or posterior crossbite with less than or equal to 1 mm discrepancy between retruded contact position and intercuspal position.
- 2.d Contact point displacements greater than 1 mm but less than or equal to 2mm.
- 2.e Anterior or posterior openbite greater than 1 mm but less than or equal to 2mm.
- 2.f Increased overbite greater than or equal to 3.5mm without gingival contact.
- 2.g Pre-normal or post-normal occlusions with no other anomalies (includes up to half a unit discrepancy).

GRADE 1 (None)

- 1. Extremely minor malocclusions including contact point displacements less than 1 mm.

MANAGING THE DEVELOPING OCCLUSION

3. How they meet, *i.e.* incisor relationship.

- i) Overjet – normal, increased, reduced, edge-to-edge.
- ii) Overbite – complete, incomplete, open.
- iii) Centre lines.

4. Buccal segments. Note crowding. Presence/absence, position and quality of all posterior teeth.

5. How they meet, *i.e.* buccal occlusion.

- i) Antero-posteriorly: Class I, Class II molars.
- ii) Transversely: for presence of crossbites.
- iii) Vertically: for open bites, etc.
- iv) Mandibular displacement.

6. Skeletal Pattern.

- i) Antero-posteriorly: to determine if the mandible is posterior to the maxilla and to what extent. This can be assessed by digital palpation with the patient sitting upright in the dental chair with their Frankfort Plane (FP) horizontal.
- ii) Vertically: An assessment of the Frankfort-Mandibular Plane Angle (FMPA) gives some idea of the difficulty of the case. Both extremes tend to be difficult. A very low FMPA suggests difficulty in reducing a deep overbite or spaces in the arch that would be difficult to close. A high angle indicates an increased lower facial height with concomitant reduction in the lip competence. Post-treatment stability may be questionable.
- iii) Transversely: note any chin or nasal asymmetry.

7. Soft Tissues.

The soft tissues of the lips and tongue often adapt to an abnormal tooth position and may exacerbate a malocclusion caused primarily by the skeletal pattern. For example, the lower lip may rest behind the upper incisors to help form an anterior oral seal. This can cause the upper incisors to procline further.

8. If as a result of the clinical assessment there are findings which require further investigation, then appropriate radiographs may be justified (see Orthodontic Radiographs Guidelines 3rd Ed 2008 BOS).

The vast majority of abnormalities fall into one or other of the categories discussed earlier. It is relatively simple to progress from this diagnostic analysis to a “problem” list and on to a provisional treatment plan.

Your initial assessment might indicate that a malocclusion is present which could be corrected with treatment. However, the patient and parent may not be aware that a problem exists. It is important to ascertain at this stage whether treatment would be appropriate, bearing in mind the severity of the occlusal problem as well as the patient’s attitude, motivation and oral health.

The following questions may help in this decision process:

1. Is the orthodontic condition a genuine problem, and to whom?

2. Is orthodontic advice required and can you provide it?

3. If not, at what level is specialist advice required?

The nature of the problem should be explained to the child/parent(s) together with possible solutions. In addition, you should discuss with the child/parent(s) what is expected of them in terms of compliance, the appliances likely to be required, the duration of treatment and the need for retention following active orthodontic treatment

The advantages and shortcomings of various types of treatment should also be discussed, where appropriate, before deciding on further action. Time taken to counsel the patient and parent at this stage is time well spent. If you consider that removable appliance therapy is indicated, are you confident that a significant and stable improvement will be achieved? Remember that extracted teeth cannot be replaced. Above all, it is imperative that you do no harm. If in any doubt, seek specialist advice.



22



23



24

SOFT TISSUES.

The variation in lip morphology and behaviour is almost infinite. There are, however, some characteristic patterns to be aware of.

22. The very active ("strap-like") lower lip which pulls back against the lower incisors. Here, any overjet is likely to be partly due to retroclined lower incisors.

23. The lower lip which rests behind the upper incisors is likely to procline them and contribute to any increase in overjet.

24. A short upper lip length or high upper lip line will contribute to a lips-apart posture. The stability of any overjet reduction in these cases will be in some doubt.

TREATMENT PLANNING

1 SPACE CONSIDERATIONS

The alignment of crowded or rotated teeth or the reduction of an increased overjet frequently requires space. This may be provided either by expansion of the arches or by the extraction of permanent teeth. Throughout the first half of the last century, the proponents of both extraction and non-extraction therapies were in vehement opposition. These two “schools of thought” persisted until the latter part of the 20th Century when common sense prevailed. It is now recognised that each method has its place in contemporary orthodontic practice.

In cases with crowding of less than 4mm, sufficient space may be gained by expansion but stability may be a problem in the long term. Patients with crowding of more than 4mm are more difficult to categorise and may be treated either by extraction or expansion techniques. The choice is normally made on an individual basis on the grounds of the type of malocclusion, facial aesthetics and stability. It is governed by the position of the teeth and the anticipated soft tissue response to any changes in tooth position.

Although expansion is now accepted as a legitimate method of space creation, it must be carried out carefully and within prescribed limits. In general, to be confident of long-term stability, a maximum of 2mm forward movement of incisors, 2-3mm lateral expansion of premolars and molars and zero inter-canine expansion is all that can be permitted.

25. Remember to confirm the presence, position and morphology of all permanent teeth before any extractions. The unerupted UL5 is being deflected into the UL4 space and could easily be extracted in error.



2 EXTRACTIONS

Lower incisor crowding is so prevalent that it may be regarded as the norm. It is **not** the result of pressure from erupting permanent third molars but is due to late growth changes and soft tissue maturation. Mild crowding is probably more difficult to treat than severe crowding, since the loss of one tooth in each quadrant will leave excessive residual spacing. If the appearance of the teeth is satisfactory, it may be wise to accept a mild degree of crowding rather than embarking on prolonged and unwanted treatment with fixed appliances. It must be remembered that if the first premolars are extracted there is a risk of increased overbite and reduction of intercanine width; residual space is also likely to be a problem in the absence of treatment. It is worth seeking specialist advice if there is any doubt regarding extractions.

PLANNING EXTRACTIONS

Look at the lower arch first. If moderate crowding of the lower incisors is present, it may be necessary to extract in the lower arch. If the degree of crowding is such that extractions are considered necessary, then either the first or second premolars are likely to be the teeth of choice for extraction. The final choice of extraction pattern will be determined by the degree of crowding as well as the condition and position of the remaining permanent teeth. The ectopic position of the permanent canine or the hypoplastic nature of a second premolar may dictate their loss. Similarly, a lower incisor may be non-vital and discoloured or severely misplaced. These features complicate treatment planning and are ample justification for seeking specialist advice.

Consider the upper arch. If extractions are required in the lower arch, then extractions will usually be required in the upper arch. Once again, the first or second premolars are likely to be the teeth of choice for extraction, unless second premolars are absent or hypoplastic or first permanent molars are of poor quality. If space is tight and the molar relationship is Class II, anchorage reinforcement or distal movement with extra-oral traction (*i.e.* headgear) or orthodontic mini-screws may be indicated.

If the lower arch is well aligned, it may be possible to carry out treatment by extracting in the upper arch only. Alternatively, it may be possible to recreate space in the upper arch by moving the upper buccal segments distally with headgear.

3 WHAT TO REFER FOR SPECIALIST ADVICE

1. Severe skeletal problems, including those where functional appliances may be indicated in the late mixed dentition stage of dental development.
2. Patients with unerupted teeth of doubtful prognosis, especially impacted maxillary canines.
3. Uncertain choice of extraction patterns.
4. Teeth which require derotation or bodily movement.

RETENTION

Any treatment more complex than pushing a single incisor over the bite requires a period of retention. At the end of active treatment, there is an almost universal tendency for the teeth to relapse. It is important to remember that the mouth is a complex biological system, which undergoes constant change throughout an individual's life. The fibres of the periodontal ligament and gingivae are put under tension or pressure during the active stages of treatment. Research has shown that it takes 9-12 months for these fibres to re-attach so that tension no longer exists. A period of retention is essential during this re-orientation process. This is normally provided by some form of passive removable appliance. It is difficult to offer hard and fast rules for the ideal length of retention period as it varies from patient to patient depending on the specific features of their original malocclusion. The minimum period is usually 3-6 months full-time followed by six months night-time wear. Even after a period of retention, there is likely to be some slight movement (relapse/deterioration) of the position of the teeth. Corrected rotated teeth may require some form of "permanent" retention. Patients are often advised to wear their removable retainers one or two nights each week for the rest of their lives if they want their teeth to remain straight. There is an increasing tendency to use prolonged or indefinite retention regimes nowadays.

ADULT ORTHODONTICS

Although the majority of orthodontic treatment is carried out on adolescents during their active skeletal growth period, it would be wrong to advise adults that orthodontic treatment is not possible for them. Many adults are now prepared to undergo complicated orthodontic treatment. However, they should be advised that treatment will take several months longer than the equivalent treatment for a child. Adult teeth move less readily through denser bone and the multi-disciplinary nature of adult orthodontics makes their treatment more complex and demanding. Refer adults to an orthodontic specialist for further advice.



26, 27 & 28. This case illustrates the degree of improvement that can be routinely achieved with fixed appliance therapy..

29. Scrupulous oral hygiene and dietary control are essential during fixed appliance therapy to avoid possible damage to the teeth caused by plaque collecting around the brackets and acid erosion from soft "fizzy" drinks.

RECOMMENDED READING

- An Introduction to Orthodontics.* L. Mitchell. 3rd ed. Oxford University Press 2007 ISBN 9780198568124
- Handbook of Orthodontics.* M. Cobourne & A. DiBiase. Mosby. 2010 ISBN 9780723434504
- Orthodontics at a Glance.* D.S. Gill. Blackwell. 2008 ISBN 9781405127882
- A Clinical Guide to Orthodontics.* D. Roberts-Harry & J. Sandy. BDJ series. 2003 ISBN 0904588765
- Interceptive Orthodontics.* A. Richardson. 4th ed. BDJ. 2000 ISBN 0904588564
- Royal College of England Faculty of Dental Surgery National Clinical Guidelines at: www.rcseng.ac.uk/fds/clinical_guidelines



This booklet is designed to assist general dental practitioners with their examination of children from an orthodontic point of view. It highlights the assessment of children at the different stages of their dental development and outlines the interceptive procedures and treatments available to deal with those conditions most commonly encountered in general practice.

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