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Guidance of eruption for general practitioners

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The principle of early treatment through well-planned extraction of primary teeth followed by removal of permanent teeth has stood the test of time. The objective of this article is to develop some simple guidelines for general dental practitioners to perform 'guidance of eruption' in malocclusion with severe crowding.

Key words: Orthodontics, serial extraction, guidance of eruption, malocclusion, crowding

The principle of early treatment through well-planned extraction of primary teeth followed by removal of permanent teeth has stood the test of time. Kjellgren[1], Dewel[2], Lloyd[3], Dale[4] and others in the United States, and Heath[5], in Australia, have helped to make 'serial extraction' an accepted method of treatment throughout the world. However, the expression 'serial extraction' tends to oversimplify and implies a 'cookbook' method of treatment. In fact, a thorough knowledge of morphology, growth, and development as well as correct timing is essential when one is employing this mode of therapy. In German speaking countries, the term 'guidance of eruption' is used to encompass all measures available for influencing tooth eruption[6]. Nataka and Wei[7] have titled their book, *Occlusal Guidance in Pediatric Dentistry* based on the same principle. The goal of 'guidance of eruption' is to avoid the need for active orthodontic treatment or to reduce it to a minimum. This form of treatment is particularly appealing in many countries that have a severe shortage of qualified orthodontists. In these countries, general dental practitioners are called upon to relieve the severe crowding in the developing dentition. They are ideal for this task since they see patients at a very young age and at regular intervals. If general dental practitioners are equipped with a good knowledge of the growth and development of the jaw and dentition, they can be of great help in reducing the severity of the malocclusion and the length of comprehensive orthodontic treatment if necessary and when. The objective of this paper is to develop some simple guidelines for general dental practitioners to perform 'guidance of eruption' in malocclusion with severe crowding.

Clinical guidelines

Diagnosis of the malocclusion should be performed in three planes of space together with a total space analysis

Guidance of eruption begins with proper diagnosis of the malocclu-

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Figure 1. Profile convexity or concavity results from a disproportion in the size of the jaws. A. A line dropped from the forehead (Glabella) to the base of the nose (Subnasale), and a second line extending from that point downward to the chin (Pogonion) should form a nearly straight line. B. A convex profile indicates a Class II jaw relationship, which can result from either a maxilla that projects too far forward or a mandible too far back. C. A concave profile indicates a Class III relationship.

sion. Diagnosis should be performed in three planes of space to determine whether the jaws are proportionately positioned in the anteroposterior, transverse and the vertical planes of space[8]. In addition, a total space analysis should be performed in order to determine whether timely extractions of primary or permanent teeth are necessary. Assuming that the dentist does not have expertise in cephalometric analysis for the full diagnosis, one can still make a reasonable approach to this by using clinical measures that are more readily available. A clinical judgment of the skeletal Class of malocclusion can be made **using clinical evaluation of the facial profile by observing the soft tissue profile and study casts[9,10].**

Establish whether the jaws are proportionately positioned in the anteroposterior plane of space

From the experience of the authors, guidance of eruption is most favourable if performed on patients with orthognathic facial profile. Guidance of eruption can be an important part of Class II treatment. However, if one does not exercise extreme caution, the malocclusion can be aggravated[4]. To perform a profile analysis, the patient is placed in a natural head position or looking at a distant object. With the head in this position, note the relationship between two lines (*Figure 1*), one dropped from the forehead (Glabella) to the base of the nose (Subnasale), and a second one extending from that point downward to the chin (Pogonion). These line segments should form a nearly straight line (*Figure 1A*). An angle between them indicates either profile convexity or profile concavity. A convex profile indicates a skeletal Class II jaw relationship (*Figure 1B*) and a concave profile indicates a skeletal Class III jaw relationship (*Figure 1C*).

Evaluate lip posture and incisor prominence

Detecting excessive incisor protrusion or retrusion is important because of the effect on space within the dental arches. Teeth that are protruded excessively can be detected by prominent and everted lips (*Figure 2*). Lips that are separated at rest by more than 3–4mm are considered to be incompetent. For such a patient, retracting the teeth tends to improve both lip function and facial aesthetics. To evaluate the vertical relationship of the dentition to the lips, it is helpful to observe the patient with the lips in repose and upon smiling. When soft tissue and hard tissue relationships are correct, the incisal edges of the maxillary teeth should be slightly exposed at rest, and upon smiling, only a small amount of gingiva should be exposed.

Determine if expansion of the dental arch is necessary

Constriction of the maxilla can be detected by observing the presence of a unilateral or bilateral posterior crossbite. It is also important to evaluate the width of the mandibular arch. Lingual tipping of the mandibular posterior molars in the absence of a posterior crossbite also requires maxillary expansion in conjunction with uprighting of the mandibular buccal segments. In general, every millimetre of posterior expansion produces about 0.7mm of additional arch perimeter[11].

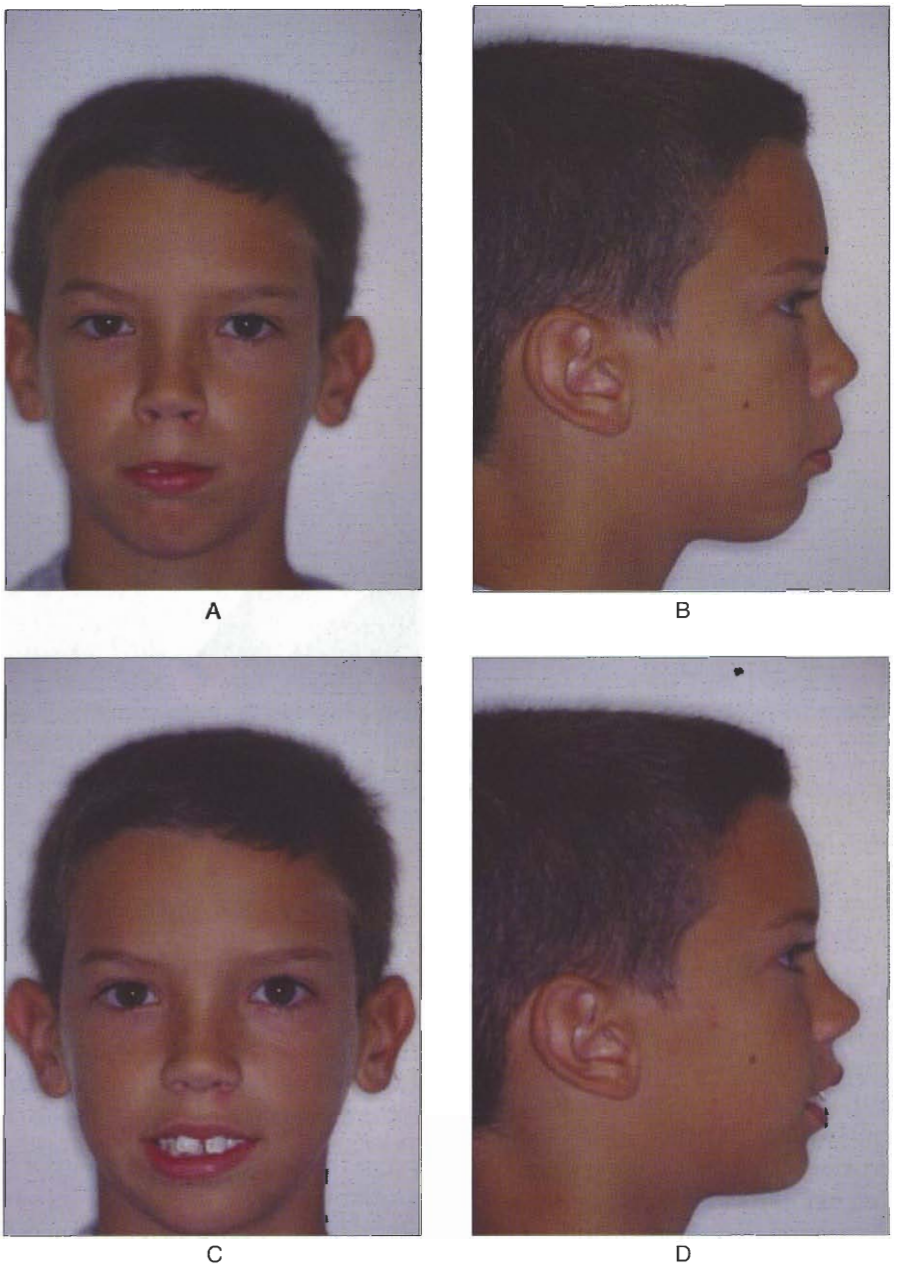


Figure 2. Evaluation of lip posture and incisor prominence. A. Anterior view of patient showing lip strain and lip incompetence due to prominence of incisors. B. Lateral profile of patient showing prominence and everted lips. C. Anterior smiling view of patient showing prominence of incisors. D. Lateral smiling profile of patient showing prominence of incisors as well as relation of incisors to facial profile.

Evaluation of vertical facial proportions and mandibular plane angle

Often, high angle facial patterns are associated with an open bite malocclusion. Patients with skeletal open bite malocclusion are characterised by an increased lower facial height relative to the total facial height; excessively steep mandibular plane angle and overeruption of the maxillary molars and incisors[12]. In these cases, orthopaedic intervention may be required. In a few cases, extraction of the permanent molars or orthognathic surgery may be more preferable to extraction of the premolars in an attempt to correct the anterior open bite.

On the other extreme, extraction of permanent teeth in skeletal deep bite cases with decreased lower facial height should be exercised with caution. Extraction of permanent first premolars is usually accompanied by retraction of incisors. This is contraindicated in skeletal deep bite cases in which overbite is usually corrected by proclination of incisors. Evaluation of vertical facial proportion can be performed by dividing the face into vertical thirds from the receding hairline to the landmark Glabella, from Glabella to Subnasale and from Subnasale to Menton. An increase in the lower third of the face indicates a skeletal open bite problem. A decrease in the lower third of the face indicates a skeletal deep bite problem. In the clinical examination, the mandibular plane angle can be determined using the mandibular-occipit rule. A normal mandibular plane usually inclines along the lower border of the mandible and intercepts with the occipital bone. A steeper mandibular plane angle correlates with long anterior facial vertical dimensions and anterior open bite malocclusion, while a flat mandibular plane angle correlates with short anterior facial height and deep bite malocclusion.

Figure 3 shows an 11-year-old patient with a convex hyperdivergent profile and a retrognathic mandible. The patient also exhibited an increase in lower facial height, narrow maxilla, crowding in the maxillary arch and long clinical crowns. Extraction treatment is contraindicated because it will worsen the facial profile. Any mechanics that allow eruption of the posterior molars will steepen the mandibular plane and aggravate the Class II malocclusion. In this patient, maxillary expansion and orthopaedic treatment with high-pull headgear were used. *Figure 4* shows the result after comprehensive orthodontic treatment. Note the facial profile at the age of 15 years became more convex and retrognathic after the pubertal growth spurt.

Total space analysis to determine if timely extractions of primary or permanent teeth are necessary

Dental study casts are essential to make an accurate diagnosis of the spaces available and their proper management. A mixed dentition analysis such as the Tanaka Johnson[13] or the Moyers[14] analysis can be performed to estimate the amount of crowding. However, in order to make a more accurate account of the crowding in the mandibular arch, the following five areas should be considered: Molar relationship, mandibular incisal crowding, incisal inclination, midline deviation and the steepness of the Curve of Spee. An end-to-end or Class II molar relationship with little or no leeway space will require space in the mandibular arch for converting into a Class I molar relationship. The overlap and rotation of the mandibular incisors or canines will require space for alignment. Excess proclination of the mandibular incisors will require space for incisal retraction (every 1mm or 3 degrees of incisal retraction will require 2mm of arch perimeter space). Finally, any midline deviation and excess curve of Spee will require additional arch perimeter for correction. In general, cases with more than 6mm of mandibular crowding will usually require guidance of eruption and ultimately extraction of permanent teeth.

Guidance of eruption is indicated in cases with genetic tooth size/jaw size discrepancy

Timely extractions of primary and permanent teeth are usually indicated in cases with a continuing discrepancy between tooth material and deficient arch length

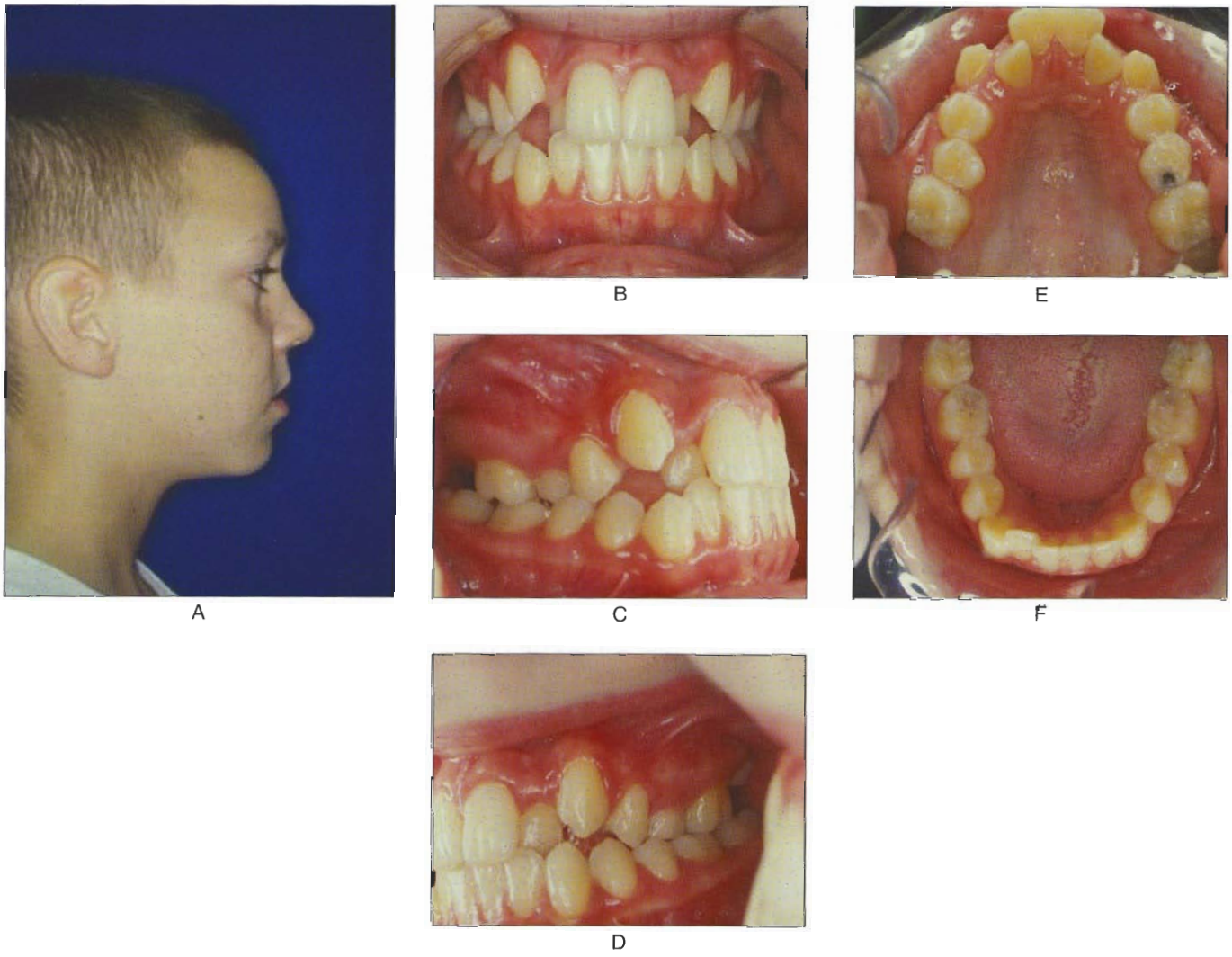
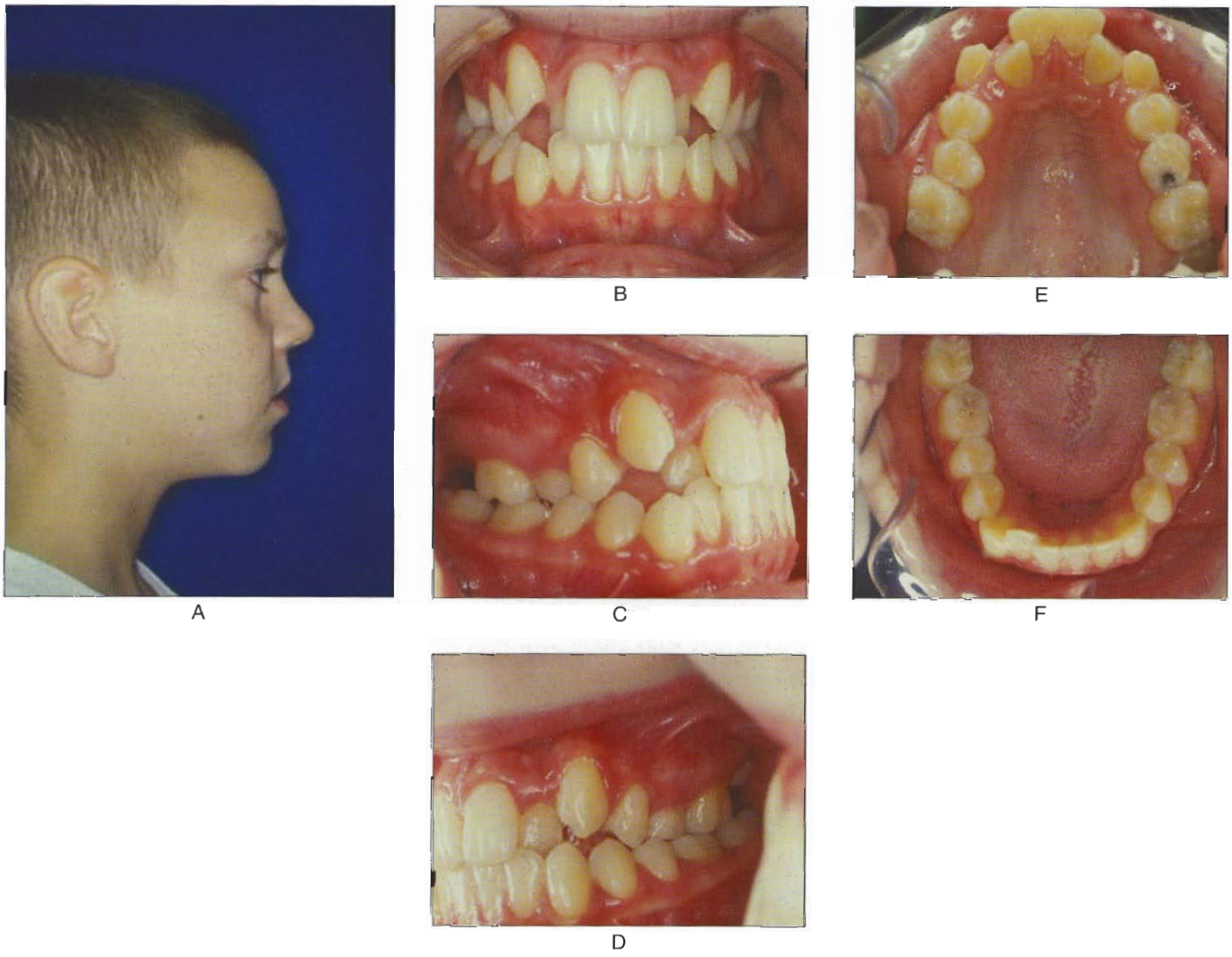


Figure 3. A. An 11-year-old patient with a convex hyperdivergent profile, retrognathic mandible and an increase lower facial height. B–F. Intraoral photographs showing long clinical crowns, narrow maxilla and crowding in the maxillary arch.

(genetic tooth size/jaw size discrepancy). Patients with severe crowding can be diagnosed as early as the primary dentition. According to Baume[15], a primary dentition without spacing is followed by crowding in the permanent dentition 40 per cent of the time. These cases usually have 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 will usually result in relapse or periodontal problems.

Cases that fall into this category are characterised by shortened arches, blocked-out or malposed incisors, a midline displacement of mandibular incisors, and frequently early loss of one or both of the mandibular primary canines. Favourable cases include those with acceptable facial profile; where molars are usually in a Class I relation with a reasonable overjet and



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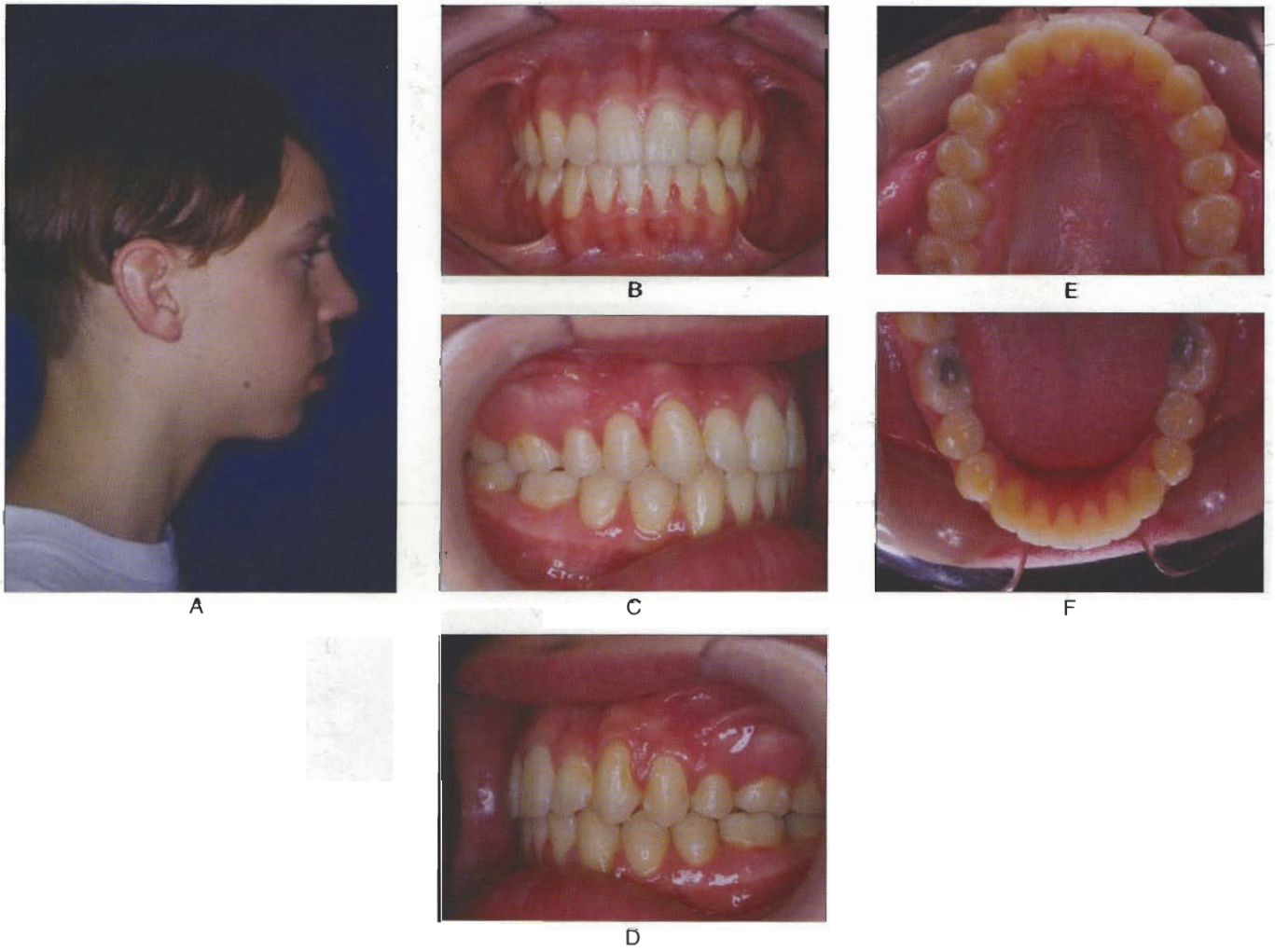


Figure 4. A. Lateral profile of the same patient after comprehensive orthodontic treatment. Note the facial profile at the age of 15 years became more convex and retrognathic after pubertal growth spurt. B–F. Intraoral photographs showing an acceptable occlusion despite an unfavourable hyperdivergent growth pattern.

overbite. *Figure 5A* shows an 8-year-old patient with a convex facial profile, normal divergent mandibular plane, protrusive upper and lower lips and an acute nasal labial angle. Intraoral photographs (*Figures 5B–F*) revealed alveolo-dental protrusion with severe crowding of the maxillary and mandibular arches and blocked-out maxillary and mandibular lateral incisors. The panoramic radiograph (*Figure 3G*) shows anterior crowding with the permanent mandibular lateral incisor resorbing the primary canine; mid-arch crowding with the maxillary canine positioning above the permanent premolars and posterior crowding with ectopically erupted maxillary right permanent first molar. These are signs of hereditary tooth size/jaw size discrepancy. Extraction of the primary canines will facilitate the eruption of the permanent lateral incisors. Timely extraction of the primary first molars will hasten the eruption of the permanent first premolars. Finally, the extraction of the permanent first premolars

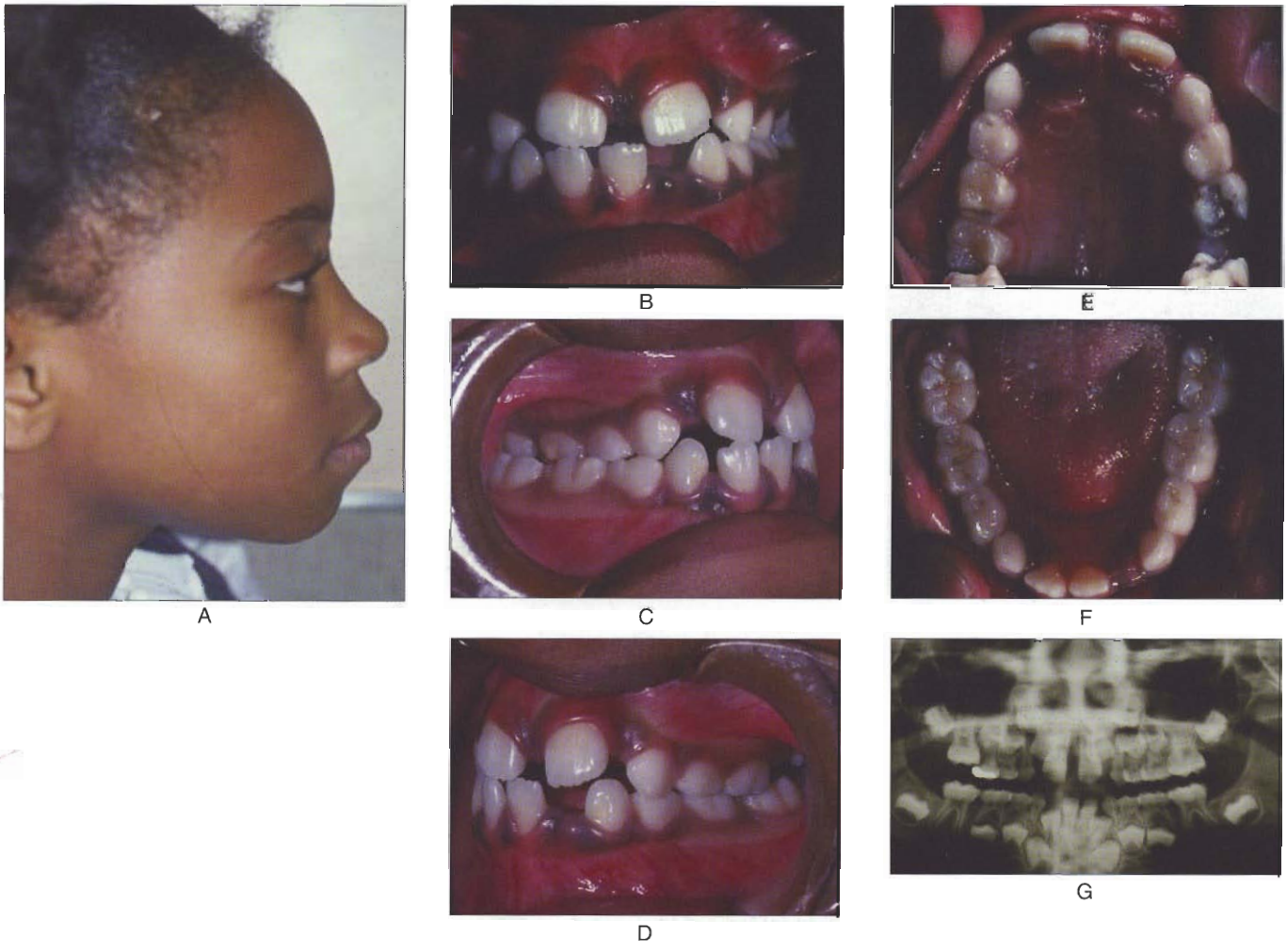


Figure 5. A. An 8-year-old patient with a convex facial profile, normal divergent mandibular plane, protrusive upper and lower lips and an acute nasal labial angle. B–F. Intraoral photographs showing alveolodental protrusion with severe crowding of the maxillary and mandibular arches and blocked out maxillary and mandibular lateral incisors. G. Panoramic radiograph showing anterior crowding with the permanent mandibular lateral incisor resorbing the primary canine; mid-arch crowding with the maxillary canine positioning above the permanent premolars and posterior crowding with ectopically erupted maxillary right permanent first molar.

will allow favourable eruption of the permanent canines into the dental arch.

Guidance of eruption is not a cookbook method of treatment

The average age when children are placed under interceptive guidance is from 7 years old during the eruption of the permanent incisors. It extends for a period of 5–6 years until approximately 12 or 13 years of age. The classic procedure for serial extraction of primary and permanent teeth has been the elimination of primary canines (sometimes spontaneously exfoliated), primary first molars, and permanent first premolars. However, the results will be more rewarding if one does not cling to a particular sequence but vary it according to the

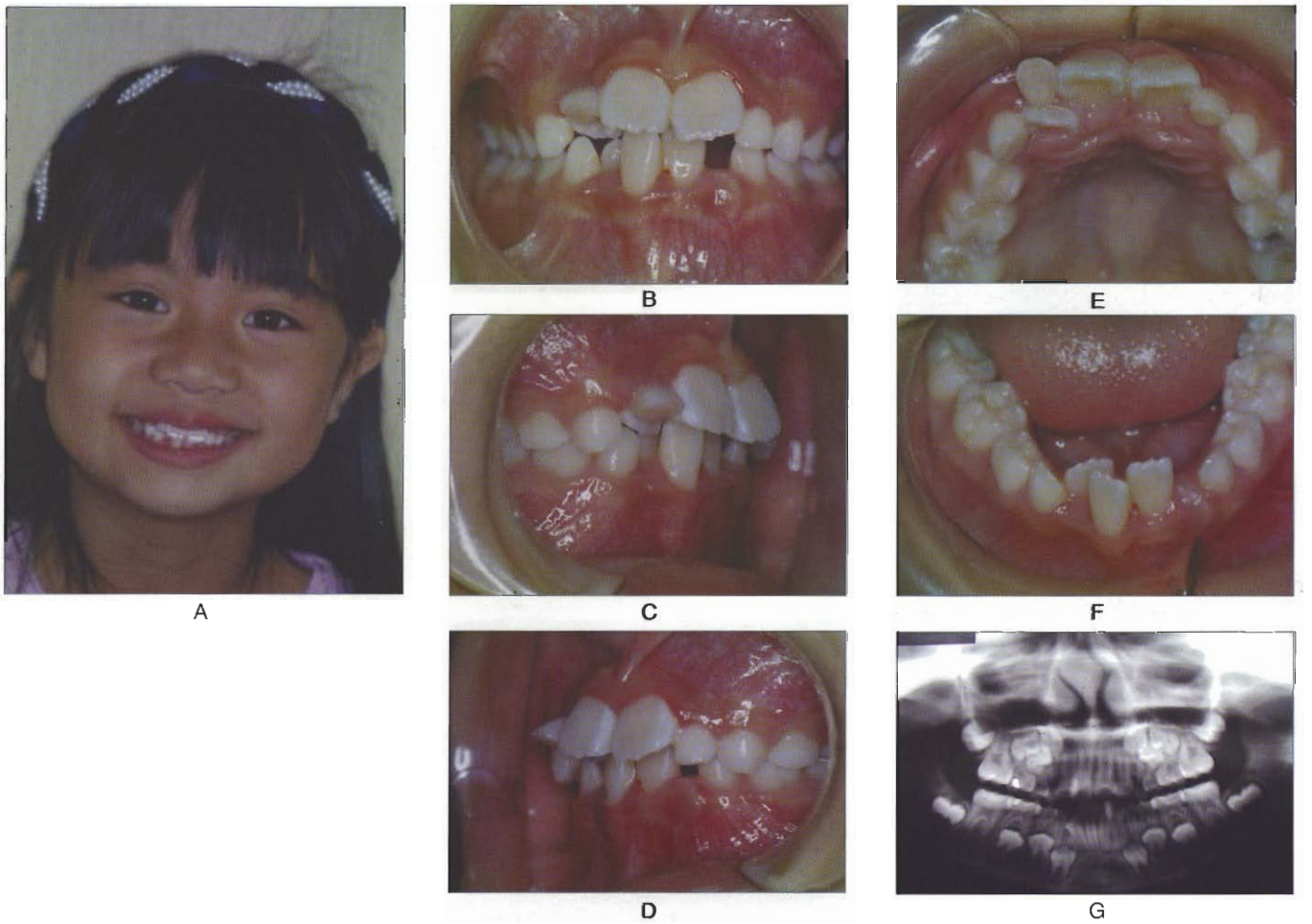


Figure 6. A. A 7-year-old patient with a convex facial profile and moderate overjet and a deep bite. B–F. Intraoral photographs showing severe crowding of the maxillary and mandibular incisors. G. Panoramic radiograph showing favourable eruption of the mandibular premolars ahead of the canines.

malocclusion. The following two cases illustrate the variation in extraction sequence according to the malocclusion.

Case 1

Figure 6A shows a 7-year-old patient with an orthognathic convex facial profile and a moderate overjet and deep overbite. Clinical examination revealed severe crowding of the maxillary and mandibular incisors (*Figures 6B–F*). Crowding in the mandibular arch was manifested by rotations and lingually blocked out lateral incisors. Crowding in the maxillary arch was manifested by protrusion of the incisors without interproximal spacing. The panoramic radiograph (*Figure 6G*) shows favourable eruption of the mandibular premolars ahead of the canines. The space analysis indicated 12mm of crowding in the mandibular arch. The primary canines were extracted to relieve the incisor crowding. *Figure 7* shows the improvement in the alignment of the incisors following extraction. The extraction site was reduced in size. The radiograph indicated the

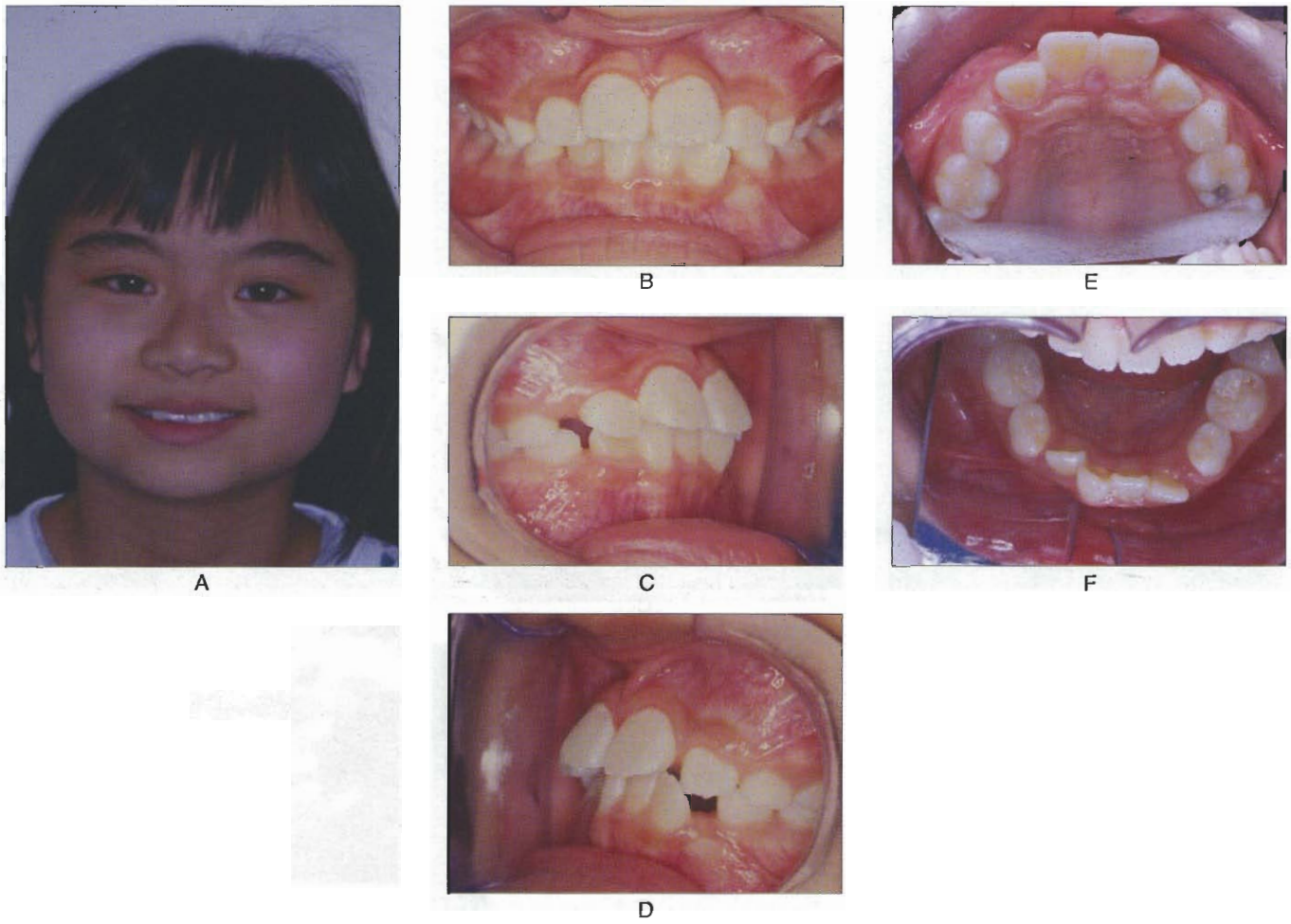


Figure 7. A. Extraoral photograph showing improvement in facial aesthetic after extraction of the primary canines. B–F. Intraoral photographs showing improvement in the alignment of the incisors following extraction of the primary canines.

premolars had reached one half of their root lengths. The extraction of the primary first molar will encourage the eruption of the first premolar teeth. *Figure 8* shows the eruption of the premolars after the extraction of the primary molars. The premolars were extracted when they emerged into the oral cavity. The timely removal of the premolars encouraged the permanent canines to erupt into

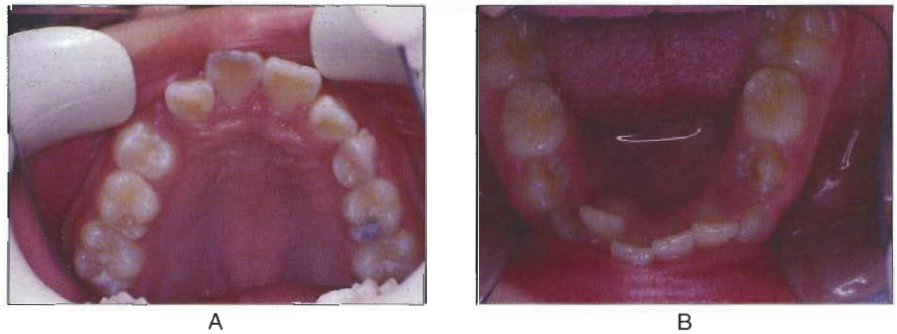
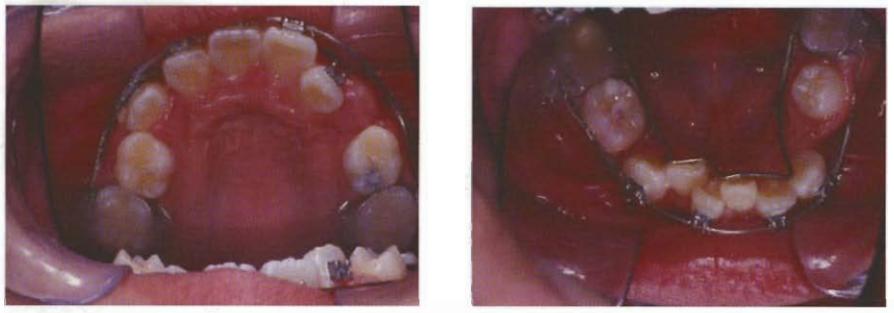


Figure 8. Intraoral photographs showing eruption of the premolars following extraction of the primary first molars. Note the simultaneous eruption of the mandibular canines and first premolars in the mandibular arch.



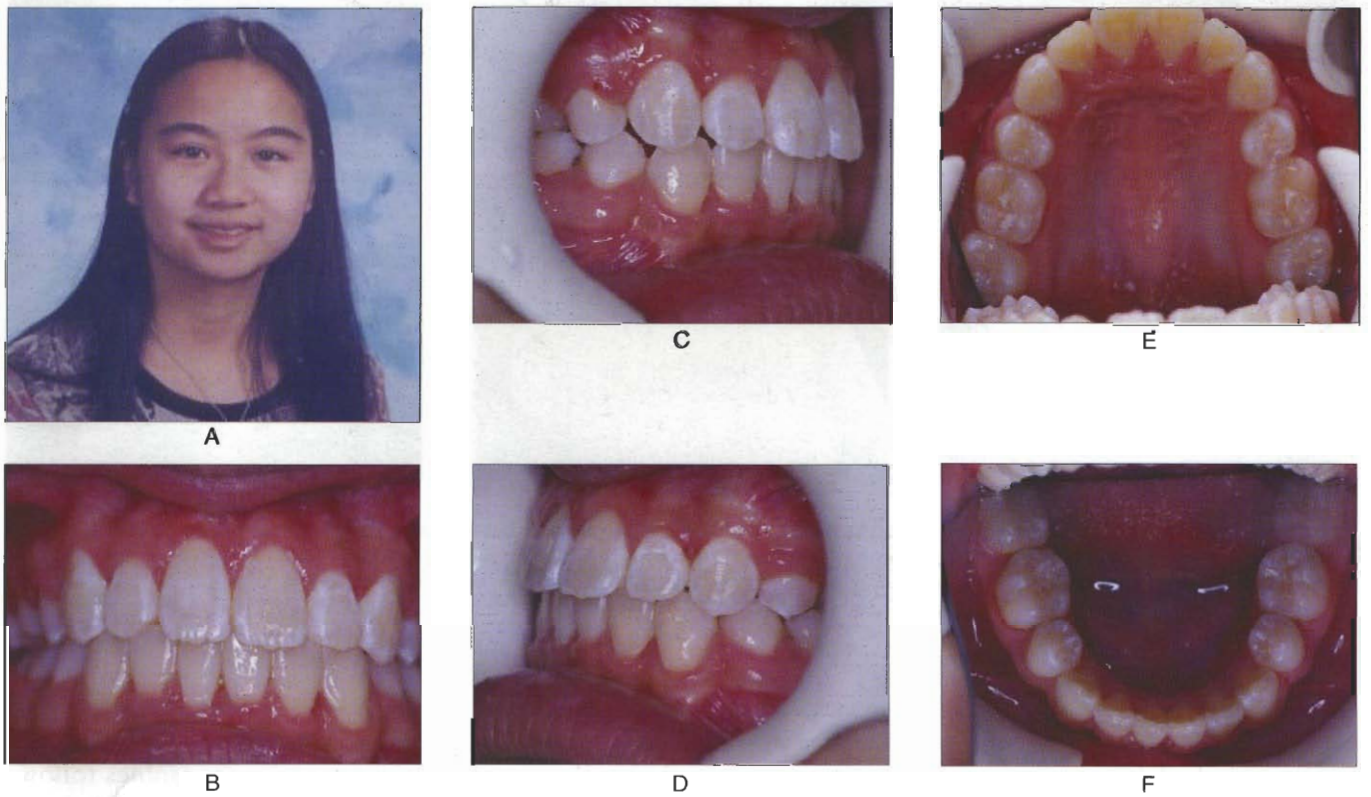
A B

Figure 9. Intraoral photographs showing the eruption of the permanent canines into a favourable position and placement of a lower lingual holding arch appliance to prevent mesial movement of the permanent first molars.

a better position in the dental arch (*Figure 9*). *Figure 10* shows the result after a short phase II multibanded treatment to close the residual extraction space.

Case 2

Figure 11A shows a 7-year-old patient with an orthognathic facial profile and a favourable interincisal relationship. Clinical examination



A C E

B D F

Figure 10. A–F. Extraoral and intraoral photographs of the same patient after a short phase II multibanded orthodontic treatment to close the residual extraction space.

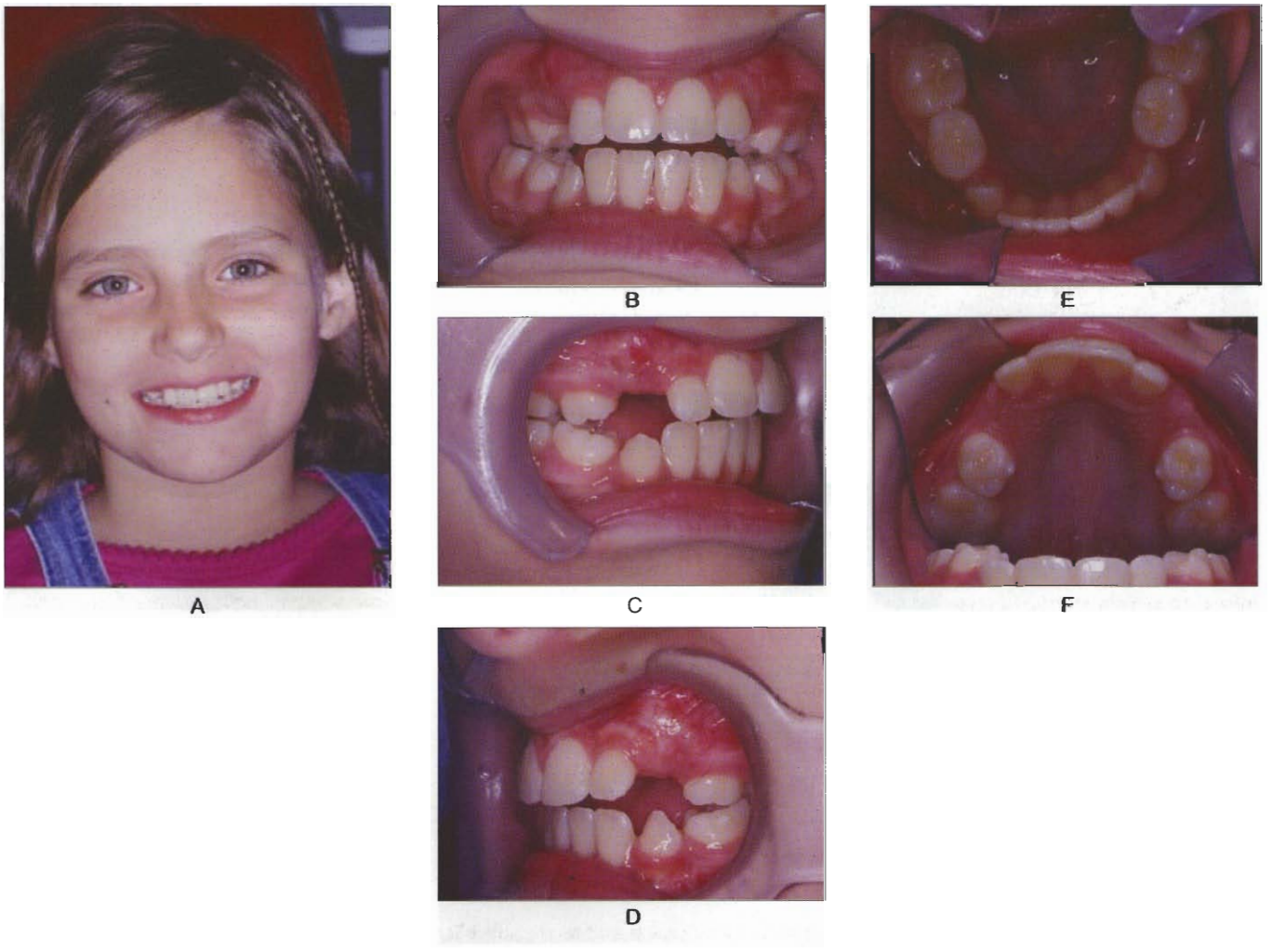


Figure 12. A–F. Extraoral and intraoral photographs showing improvement in facial aesthetics and the eruption of the mandibular permanent canines following simultaneous extraction of the primary first molars and the enucleation of the first premolars.

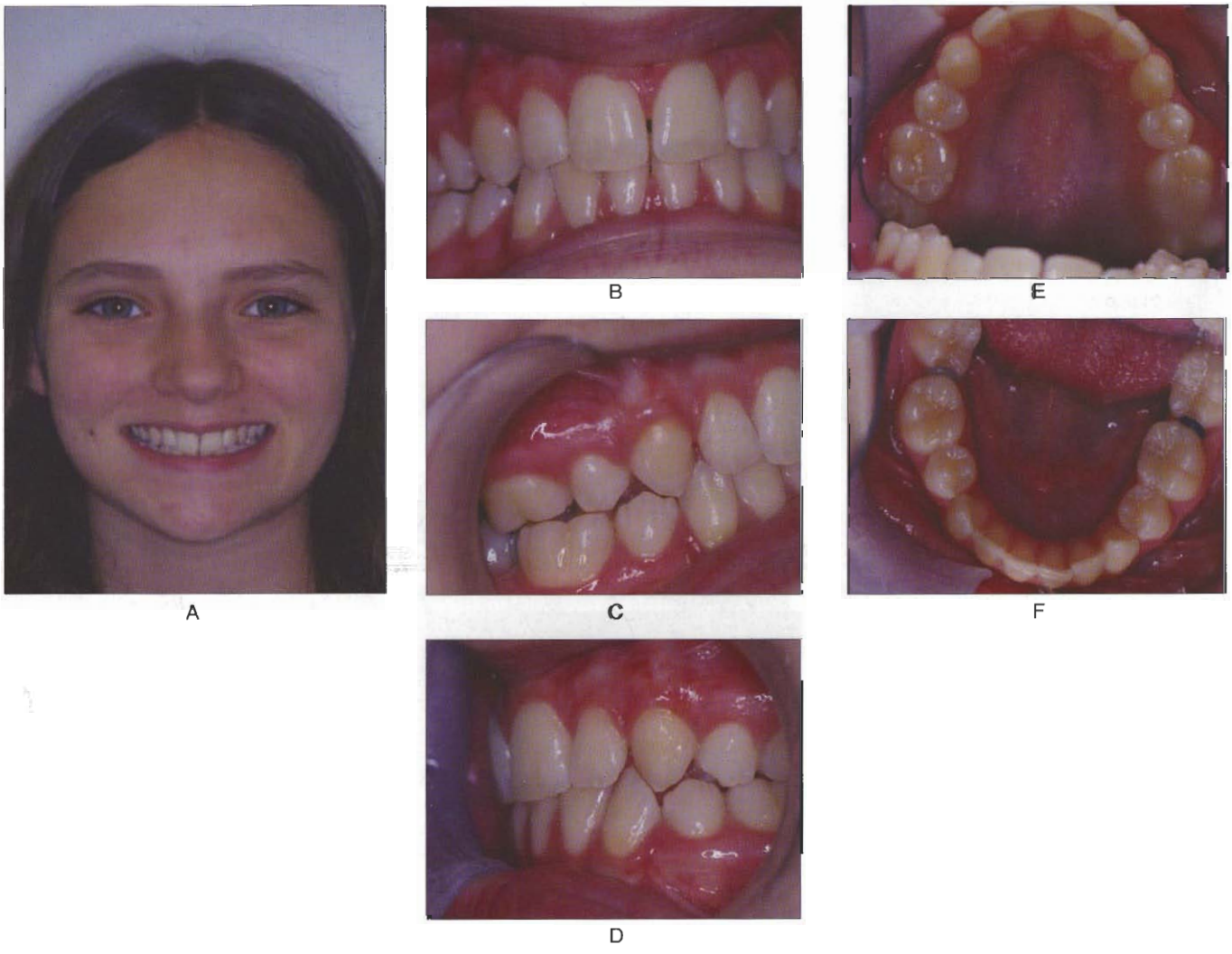


Figure 13. A–F. Extraoral and intraoral photographs showing acceptable facial aesthetics and occlusion after guidance of eruption without a phase II multibanded orthodontic treatment.

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