Recognizing and Correcting Developing Malocclusions

Recognizing and Correcting Developing Malocclusions

A Problem-Oriented Approach to Orthodontics

Second Edition

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Dedications

To my family, particularly my wife Teresa, my daughter Kika, my son Chico, his wife Veronica, and my grandchildren Julia and Davi for the support and constant inspiration. To my parents, especially my father who, through his example, led me into dentistry. To each of my mentors, alumni from PUCMinas, Ciências Médicas de Minas Gerais and Saint Louis University, present residents, colleagues, and to each one of my patients who helped me to become a better clinician and professor. In addition, a special thanks to Drs. Orlando Tanaka, Jose Mauricio Vieira, Roberto Vieira, Júnia Lucia Vieira, and Gabriel Miranda for their help and friendship.

Eustáquio A. Araújo

Also to my family, particularly my wife Joyce, whose support and wisdom has sustained me. And to the orthodontic faculty, alumni, and residents that I have been privileged to work with – they have helped me to see the way. Together, they have made it all worthwhile.

Peter H. Buschang

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Foreword

Orthodontic educators are often confronted by loaded questions where the questioners really just want to know if their biases are shared by the educator. One of the most common questions is: "Do you teach early treatment to your students?" From experience, I know that the answer either lines up with the questioner's bias and a conversation of great agreement will follow, or the answer does not line up with their bias and a conversation of great disagreement will follow, so I prefer to provide neither expected answer, but instead aim to stimulate thought. So my answer might well be "Yes, we teach early treatment and late treatment and also very early and very late treatment. We also perform 1-phase treatment, 2-phase treatment, 3-phase, 4-, 5-, 6-, 7-, 8-, and even 9-phase treatment ... or more, if need be."

Of course, this answer is very perplexing and I am asked to explain what I mean – which I am happy to do. To provide support to my answer, I provide several examples. For one of these, I talk about a study that was performed long ago by a former graduate student named Greg Dyer [1]. He took a sample of treated adolescent females and a similar sample of treated adult females and compared the outcomes of the treatments performed. Importantly, in the adolescent group he found that growth provided 70% of the correction (i.e. the mandible outgrew the maxilla) while only 30% of the correction was due to tooth movement. In the adult sample, the growth was nil, or in some cases the maxilla outgrew the mandible and the amount of tooth movement that was necessary to correct the malocclusion was 119% – that is, the practitioner had to do all the work, and more, to make up for the poor growth, in order to correct the problem. For me, this is ample evidence that it is better to treat early (as an adolescent) as opposed to late (as an adult) in this particular situation. This example points to the meaning of my response to the question posed initially. It is not whether I am biased so that I believe only in early treatment or only in late treatment as a single choice that must be made, but rather it is that the question can only be answered in the context of the situation that is presented. In this example, my answer would be to treat early (in this case, adolescence) when you are confronted by a Class II female adolescent; don't wait till they become adults.

In the case of treatment performed in multiple phases, again it is the context of the patient's situation that dictates what to do. There is plenty of research and clinical experience available that suggests that a cleft palate patient is best treated early and often over many years, according to the many types of treatments that are arranged across many phases. There are also questions as to how many phases of treatment should be involved in an orthognathic surgery case.

So, the point that I am trying to make is that it matters little whether a practitioner "believes" in early treatment or not, and it makes little difference whether the practitioner "believes"

in single-phase treatments or some other number of phases. What really matters is that the practitioner evaluates the condition that the patient presents and then applies the best available evidence to the situation in deciding if, when, and how the treatment should be rendered. To believe otherwise suggests that the doctor can decide the approach before even seeing the patient. But adopting a prefabricated approach is seldom the best choice because patients are all custom-made.

What follows in the pages to come is blended (some old, but mostly new) information concerning genetics, normal, and abnormal growth of the craniofacial skeleton, and the development of the occlusion. Such information will form the basis for understanding and determining the timing of treatment.

You will also find important information on the construction of a diagnosis, treatment plan, and estimation of prognosis, all based on available diagnostic records produced by both old and new technologies. All three types of Angle classes will be considered in terms of development, etiology, and treatment; that is the meat of this book.

Finally, information will be provided with regard to certain overriding topics such as biomechanics, and what might be considered "orphan topics" including problems attendant to abnormal eruption, function, aesthetics, congenitally missing teeth, autotransplantation, and habits.

So, how is this book different from previous books on the topic of early and preventive orthodontic treatment? Considering the comments made earlier in this preface, this book is based on available evidence, not bias, passion, or faith; it is meant to make you think and then apply what is proven. This book is also different in that the authors are very knowledgeable each in their own areas, and each is cognizant of the value of current science and the knowledge that science generates.

Those readers who are open to the development of new information and new ideas should enjoy and embrace the knowledge and direction contained within. For those who are very biased in their thoughts and actions do not be afraid to read this book; it will open your mind and help you adjust your thoughts and actions in a positive way.

Have a good read; I think you will find it worth the effort in terms of thought and then reasoned actions that will prove beneficial to your patients.

Rolf G. Behrents

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Preface

Recognizing and Correcting Development Malocclusions: A Problem-Oriented Approach to Orthodontics, in its second edition, continues to provide evidence-based approach to early age orthodontics, an often controversial topic. Based on decades of experience in clinical practice and education, Drs. Araujo and Buschang with the support of an outstanding team of contributors, present treatment protocols for early age orthodontics treatment with various malocclusions and other problems.

Class I, Class II, and Class III malocclusions are extensively covered, along with eruption deviations and developing hyperdivergence growth and open bites. This second edition brings new topics such as Trauma and Sleep Apnea in children. The literature is comprehensively reviewed to ensure that the reader thoroughly understands the development, phenoptic characteristics, and etiology of each type of malocclusion.

Taking a problem-oriented approach, the editors and contributors provide detailed information for each case, develop comprehensive problem lists, and then provide evidence-based treatment solutions.

The clinical focus of the text is ideally suited for the private practice clinician, with numerous references and academic underpinnings to ensure its suitability for orthodontic and pediatric dentistry residents.

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A guide for timing orthodontic treatment

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When the decision was made to work on this book, the heavy responsibility of embracing the topic without bias or radicalism increased. Clinicians and academicians were initially consulted and asked to provide questions that would help establish priorities for early interventions. The responses came rapidly and contained all the sorts of questions one would imagine. ***Recognizing and Correcting Developing Malocclusions*** will try to address the collected questions and themes.

The term "early treatment" has been used for a long time, and it seems now to be fixed. Although "early" could suggest "too soon," for the sake of practicality it will be used in this book. The text will eventually also refer to timely or interceptive treatment.

Initiating orthodontic treatment during the growth spurt was often used to be considered the "gold standard" for treatment timing. The pendulum that regulates the initiation of orthodontic treatment has been swinging in different directions for many years. At present, this balance seems to have been shifting, as the pendulum appears to be swinging toward an earlier start, preferably at the late mixed dentition. The possibility of successfully managing the E-space has dramatically influenced the decision-making on the timing of orthodontic treatment [1].

At the beginning of the 20th century, some consideration was given to early treatment. A quote from Lischer [2] in 1912 says,

> Recent experiences of many practitioners have led us to a keener appreciation of the "golden age of treatment" by which we mean that time in an individual's life when a change from the temporary to the permanent dentition takes place. This covers the period from the sixth to the fourteenth year.

Soon after, in 1921, a publication [3] titled "The diagnosis of malocclusion with reference to early treatment," discusses the concepts of function and form and gives notable consideration to the role of heredity in diagnosis—so the topic with its controversies is an old one.

"The emancipation of dentofacial orthopedics," an editorial by Hamilton [4] supports early treatment. In summary, he states that:

a) healthcare professionals must do everything possible to help their patients, including early treatment;
b) it is irresponsible and unethical to prescribe treatment for financial betterment and for the sake of efficiency;
c) if the orthodontist is not willing to treat patients at a young age, others in the dental

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profession will, and it is in the patients' best interest that we, as specialists, treat these patients. After all, our flagship journal includes "Dentofacial Orthopedics" in its title;

d) it is the highest calling of healthcare professionals to incorporate prevention as a primary means of treatment, and therefore early treatment is important;
e) pediatric dentists and other health professionals are incorporating early treatment in their practice because orthodontists are waiting too long to initiate treatment;
f) orthodontic programs have the responsibility to educate orthodontists about early treatment.

On the other hand, Johnston [5] indicates in "Answers in search of questioners" that:

a) little evidence exists that two-phase early treatment has a significantly greater overall treatment effect compared with treating in one phase and considering E-space preservation;
b) treatment aimed at the mandible typically has an effect on the maxilla;
c) early treatment is not efficient for the patient or doctor and results in an increased burden of treatment;
d) functional appliances do not eliminate the need for premolar extraction, as bone cannot grow interstitially and arch perimeter is not gained with their use;
e) patients occasionally endure psychological trauma due to dental deformity, but these isolated instances are not enough to "support what amounts to an orthodontic growth industry."

In an effort to establish grounds to initiate treatment earlier or later, we must try to answer two key questions:

1) Should developing problems be intercepted and treated in two phases?
2) Which malocclusions should receive consideration for treatment at an early age?

Undoubtedly, there is much agreement on what to treat, but there is still great disagreement on when to intervene.

What are achievable objectives for early treatment? Some of the most relevant ones are using growth potential appropriately, taking advantage of the transitional dentition, improving skeletal imbalances, eliminating functional deviations, managing arch development, improving self-esteem, minimizing trauma, and preventing periodontal problems.

Early orthodontic treatment offers several potential advantages, including better patient compliance, emotional satisfaction, and the ability to harness growth potential. It may also simplify the second phase of treatment and reduce the need for extractions. Additionally, early treatment can benefit practice management. However, there are also disadvantages, such as inefficiency, prolonged treatment time, patient immaturity, challenges with maintaining oral hygiene, difficulty in caring for appliances, and higher costs. It is crucial for orthodontists to carefully weigh these benefits and risks, providing evidence-based and well-reasoned recommendations on whether or not to initiate treatment. This chapter offers guidance on the optimal timing for orthodontic interventions.

The ideal timing for treating malocclusions in growing patients has been a controversial and widely discussed topic throughout the history of orthodontics [1, 6–10]. One of the most important debates in our field is whether to interrupt the development of problems with early treatment or to postpone therapy until later [1, 9]. Such controversies are likely due to the lack of a scientific basis for therapeutic clinical decisions [8]. Historically, dentistry has been an empirical science. Even today, most dentists choose to employ solutions and techniques that were first learned in dental school or those that they believe will work [1, 9]. In such cases, there is a high probability of treatment failure or a low-quality treatment outcome.

During the search for excellence in orthodontics, the concepts of effectiveness and efficiency have been emphasized [1]. Orthodontic clinical decisions should be scientifically based. Accordingly, treatment must be postponed until strong arguments in favor of beginning the therapy are present [9].

A follow-up protocol in which patients are re-examined periodically during growth and the development of occlusion allows the clinician to decide whether the cost/benefit of early treatment is justifiable. At this time, the program "preventive and interceptive orthodontic monitoring," or simply PIOM, as devised by Souki [11] is introduced.

Conceptually, PIOM is a program of sequential attention that aims to monitor the development of "normal" occlusion and seeks to diagnose any factors that may compromise the quality or quantity of orthodontic treatment and the establishment of an appropriate occlusion. Seven objectives govern PIOM:

1) Provide prospective monitoring with a minimal intervention philosophy;
2) Provide comprehensive orthodontic care with functional and esthetically harmonious adult occlusion as the ultimate goal;
3) Establish parameters so that orthodontists are not in a hurry to start treatment but are able to have a deadline to complete treatment;
4) Establish scientific parameters as guidelines for beginning therapy at each stage of maturation;
5) Respect the normal range of occlusal development;
6) Reduce dependence on patient compliance;
7) Delay phase II, if possible, until the time when second permanent molars can be included in the final occlusion.

During the years that separate the eruption of the first deciduous tooth and the full intercuspation of the second permanent molars, many morphogenetic influences and environmental factors act on the maturation of the dental arches and the occlusal pattern. Therefore, human occlusion should be viewed dynamically.

Clinicians must understand that during occlusal development, there is not just one line of ideal characteristics but a wide range of normal characteristics. In the mixed dentition, a larger variety of normal characteristics compared to the deciduous and permanent dentitions is encountered. Knowledge of normal features of occlusal maturation is important for the practice of orthodontics within PIOM. Throughout the history of medicine/dentistry, identifying signs or symptoms of a deviation from normal has been viewed as a situation requiring interceptive action. In lay terms, it has been thought that allowing a disease to evolve naturally (without therapy) may possibly make the disease more difficult to treat or even make it incurable [7]. This belief, when applied to orthodontics, may produce unnecessary interventions for occlusal characteristics that are totally within the range of normal (Figure 1.1), treatment of transitional deviations for which interceptive treatment (phase I) is not needed (Figure 1.2), and interceptive treatment before the appropriate time (Figure 1.3).

As mentioned earlier, the orthodontist should focus on two key questions: the first deals with the ideal timing for interceptive orthodontics, incorporating the decision between one- and two-phase treatments and the second hinges on identifying malocclusions that would benefit from an early intervention.

1.1 Occlusal deviations with indications for interceptive orthodontic treatment

Interceptive problems are those that, if not stopped during the course of their maturation, may become sufficiently severe to increase the complexity and difficulty of definitive treatment, compromise the final quality, or expose

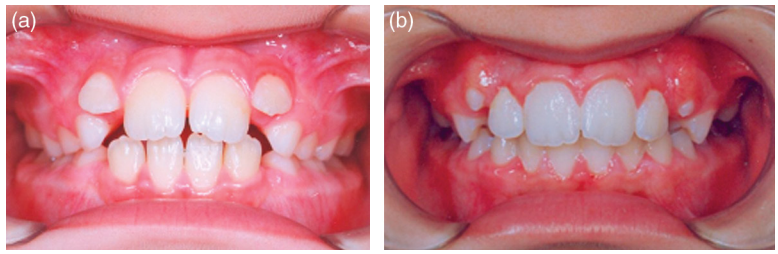

Figure 1.1 (a) A 8-year-old boy during "ugly duckling" phase presenting labial-distal displacement of maxillary lateral incisors and a diastema between the central incisors. (b) Same patient 3 years later without any orthodontic treatment. The incisors' alignment and leveling were naturally achieved.

Figure 1.2 (a, b) A 9-year-old girl presenting deep bite and positive space discrepancy. Such transitional deviations (deep bite and positive space discrepancy) have no indication of interceptive orthodontics unless palatal soft tissue impingement is observed or aesthetics is a major concern. (c, d) Same girl 5 years later presenting significant natural improvements in the deep bite and space discrepancy with no phase I treatment.

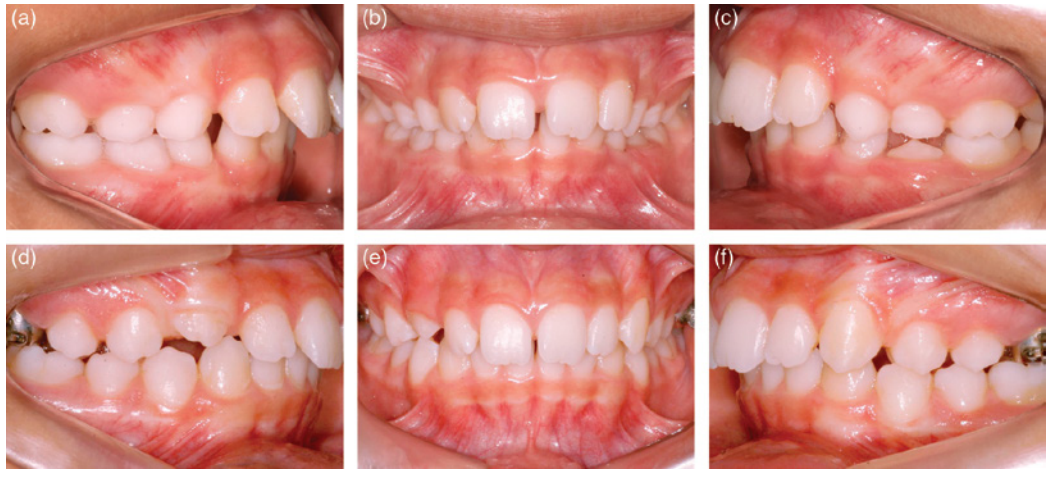

Figure 1.3 (a–c) A 9-year-old mixed dentition boy with a Class II/1 malocclusion but no psychosomatic concerns. The evaluation of a low/moderate risk of traumatic injuries in the maxillary front teeth indicated postponing to a single-phase orthodontic treatment. (d–f) Patient at 12 years old, during early permanent dentition. No interceptive orthodontic treatment was performed. After 5 months of headgear appliance, the patient is now going into the 12–18 months multibrackets comprehensive orthodontic treatment. Efficiency was achieved by postponing the Class II correction to a single-phase approach.

the individual to psychosocial conditions while waiting for a final corrective solution. Disagreements certainly exist among scholars regarding the clinical situations with indications for early orthodontic treatment. The list of issues presented by the American Association of Pediatric Dentistry [12] may serve as the starting point for this guideline. Based on their list, the following situations are suggested as candidates for early treatment: 1) prevention and interception of oral habits; 2) space management; 3) interception of deviations in eruption; 4) anterior crossbite; 5) posterior crossbite; 6) excessive overjet; 7) Class II malocclusion, when associated with psychological problems, increased risk of traumatic injury and hyperdivergence; 8) Class III malocclusion.

1.2 Ideal timing for early treatment

Several aspects must be considered by the clinician when deciding on the ideal timing for early treatment. Four basic considerations are: 1) psychosocial aspects; 2) the severity and etiology of the malocclusion; 3) the concepts of effectiveness and efficiency; 4) the patient's stage of the development.

1.2.1 Psychological aspects

Psychological aspects are often neglected by orthodontists and unfortunately have not been routinely considered during the early treatment decision-making process [13, 14].

At a time when bullying has been extensively discussed [15] and has been widely studied by psychopedagogues, clinicians must be constantly aware of the fact that, as providers, they can in many instances improve the self-esteem and quality of life (QoL) of their patients [16].

For many, the relationship between a patient's well-being and his/her malocclusion, along with possible associated sequelae has been thought to be of only minor importance [17]. Consideration must be given to each patient's QoL and the associated impact that postponement or avoidance of treatment may carry. Although somewhat vague and abstract, the concept of QoL is current and should be emphasized in orthodontics [18].

The literature provides evidence of an association between QoL and malocclusions. The methodologies of QoL studies, however, have not been homogeneous, and the samples are often constructed based on convenience, making it difficult to offer a reliable analysis. The lack of randomized samples hinders the interpretation of the evidence [18, 19].

Young people are motivated to seek orthodontic treatment because of their esthetic dissatisfaction [13], referrals from dentists [20], parental concerns [13], and the influence of peers [21]. Orthodontic treatment does improve QoL [19], but over time, the gain in QoL may be lost. When a malocclusion causes discomfort to a patient with the potential for generating a psychological imbalance [20], there is certainly an indication for early treatment [13], despite the fact that efficiency may be adversely affected [1].

1.2.2 Severity of the malocclusion

Malocclusions differ among patients presenting a wide range of severity. Therefore, it seems reasonable to think that, in infancy and adolescence, a mild malocclusion has a lower interceptive priority than a more severe one. For example, a posterior crossbite with mandibular shift (Figure 1.4a) should have treatment priority as compared to malocclusions with minor shift or not associated with functional deviations (Figure 1.4b). In the first scenario, the deviation can lead to asymmetric facial growth, making future therapy more complex [22]. There is less urgency for treatment of a single lateral incisor crossbite than a two-central-incisor crossbite (Figure 1.5), although there is a lack of evidence in the current literature about postponing interceptive approach of crossbites. It must be understood that the

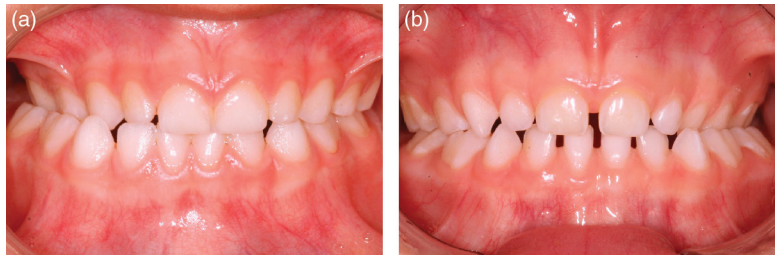

Figure 1.4 (a) Posterior crossbite with mandibular shift. (b) Posterior crossbite with no mandibular shift.

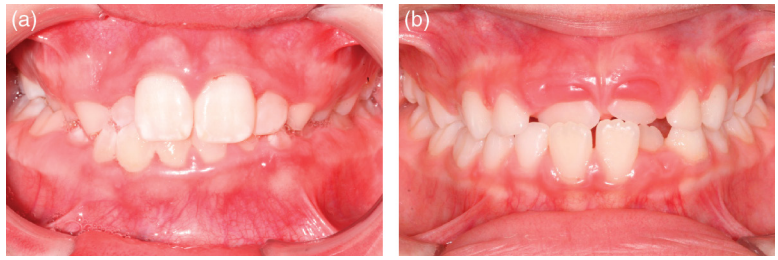

Figure 1.5 (a) A 8-year-old boy, Class I dental-skeletal pattern, presenting a single lateral incisor crossbite. (b) A 7-year-old girl, Class I dental-skeletal pattern, presenting two central incisors crossbite. Because periodontal and dentofacial growth impairments are more likely to happen in "b," it is reasonable to infer that interceptive approach should be addressed urgently.

severity of the malocclusion is not the only criterion for deciding on interceptive treatment. For example, if a Class III malocclusion is very severe in childhood, with skeletal components indicating that surgical correction may be required in the future, it is reasonable to consider delaying treatment until the end of growth to reduce extensive interceptive treatment [23, 24]. In other words, in some situations, it is advisable to postpone the correction of the malocclusion until a single-phase orthodontic-surgical treatment can be undertaken. On the other hand, many other Class III malocclusions in children may benefit greatly from an interceptive approach [24, 25].

1.2.3 Effectiveness and efficiency concepts

The decision on the best time for orthodontic treatment must also consider the aspects of effectiveness and efficiency [10]. Effectiveness is a concept that expresses the ability to effectively solve a problem. Will it work at all? How much improvement will be produced? This concept is important in the search for excellence in orthodontics. Orthodontic interceptive actions should be considered if there is evidence that the problem to be treated will, in fact, be solved by early treatment. If the problem is not intercepted, will it lead to a less acceptable final result or cause greater difficulty in obtaining a good result?

Efficiency is a formula that correlates result with time. How much time will be needed to achieve the goals? Will the financial, biological, and interpersonal burden be worth the outcome? In the contemporary world, the concept of efficiency has been an important criterion in deciding implementations of actions and services. If the cost–benefit of a phase I is unfavorable, should one consider the benefits of early orthodontic treatment?

In summary, the treatment of malocclusions in children should be considered an acceptable option if there is evidence that the outcome

will add quality (effectiveness) and will be obtained with less effort (efficiency). Be sure to get the best result in the shortest amount of time possible.

1.2.4 Maturational stage of development

The orthodontist should consider several maturational aspects [26–28]. The presence of a minimal emotional maturity is essential for beginning any orthodontic procedure, even in patients with low-complexity malocclusions [29]. These considerations are essential to improve patient comfort [30] and to reduce the risk of accidents in young children. Thus, the cooperation of the child in the clinical examination becomes the first parameter used by orthodontists in judging the potential for early treatment. Depending on the child's behavior and compliance, the clinician will decide if orthodontic records should be taken.

Psychosocial maturity is normally associated with chronological age. The American Association of Orthodontists (AAO) in its brochure *Your Child's First Check-up* recommends that children have a check-up with an orthodontic specialist no later than age 7. However, decisions about early treatment should be undertaken on an individual basis. Other parameters of maturity should also be considered. Assessment of the dental age should be made when intra-arch problems suggest early treatment. On the other hand, skeletal age should be used as a guide for the best time to intercept sagittal and vertical interarch problems [26, 27].

In conclusion, it seems clear that a thorough consideration of all the factors described here will serve two purposes: 1) to determine whether or not early treatment is necessary and 2) to provide guidelines for determining when treatment should be initiated.

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Figure 2.14 E-space maintenance with a lower lingual holding arch.

is reduced during the transition between the late mixed and permanent dentition, due to the mesial migration of the permanent first molars and the consequent occupation of the E-space. The clinician should evaluate the opportunity to maintain this precious space (Figure 2.14). The E-space can be used not only to improve intra-arch tooth alignment but also to facilitate the comprehensive orthodontic treatment of mild Class II and Class III dental relationships (Figures 2.15 and 2.16).

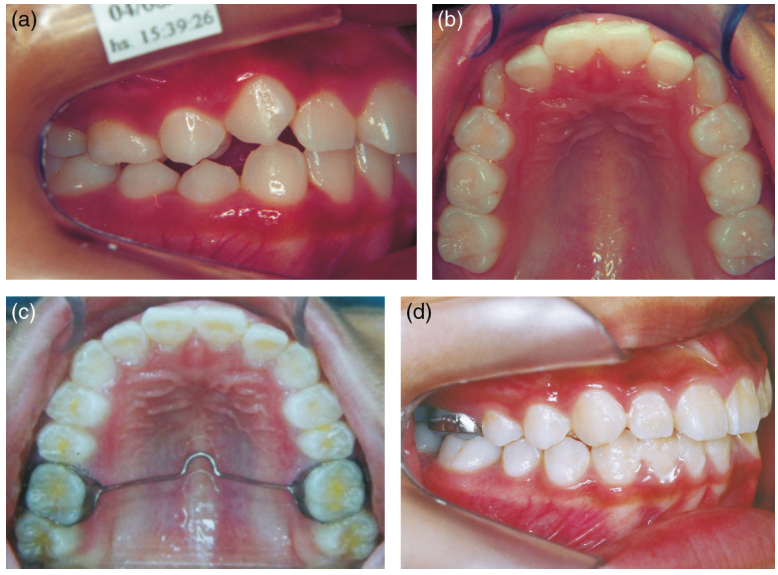


Figure 2.15 E-space preservation in the maxillary arch of Class II malocclusion patients may favor the improvement of the dental sagittal relationship.

Figure 2.16 E-space preservation in the mandibular arch of Class III malocclusion patients is recommended to allow incisors retraction and the creation of adequate overjet.

Figure 4.8 Orthodontic patient with a diagnosis of craniosynostosis and significantly disproportionate facial growth.

with population based association studies and family based linkage studies. The highest prevalence rates of Class III malocclusions are recorded in Asian, Inuit, and African populations and the lowest among Indian, US American Indian and European populations. There are several genetic loci, patterns of inheritance, and environmental factors that are thought to play a role in nonsyndromic Class III malocclusion [32–36].

Figure 4.14 This 7-year-old patient presented with molar and incisor enamel defects. His mother reported early loss of his primary teeth beginning at age 2 in the absence of trauma. Premature primary tooth exfoliation suggests a genetic or systemic disease, which might warrant referral to the pediatrician for consideration of hypophosphatasia, collagen, and immune disorders.

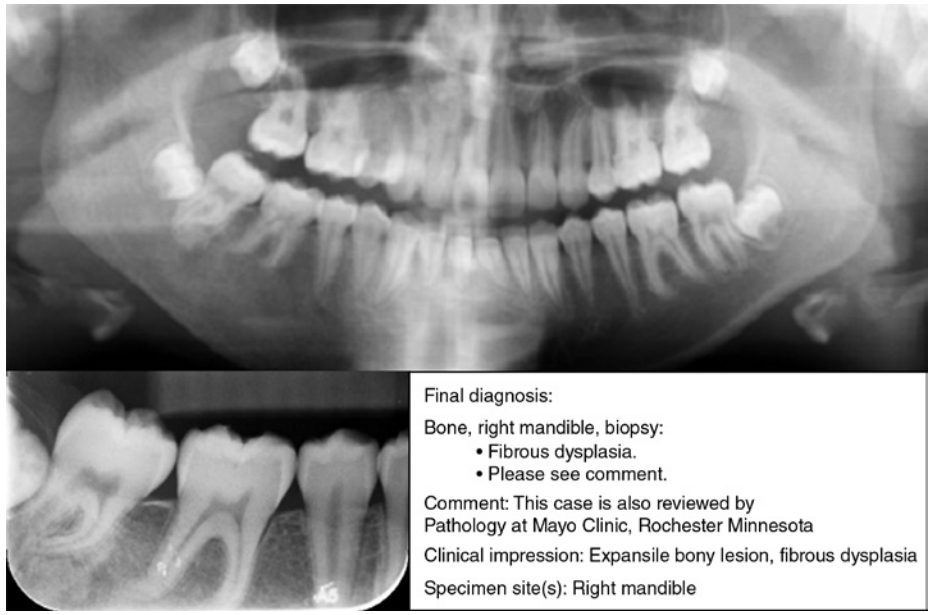


Figure 4.15 Diagnosis of fibrous dysplasia was made after referral for evaluation of a radiographic lesion at the apex of the mandibular right second molar. Often the orthodontist is the first practitioner to recognize facial asymmetry and/or radiographic evidence suggestive of fibrous dysplasia.

was brought to our clinic for evaluation. After all records were evaluated, it was decided to place a Nance button in the maxillary arch and a lower lingual holding arch in the mandible. The patient was put on observation, and 2 years later, the Class I occlusion was normal, perhaps requiring minimum if any intervention (Figures 5.23–5.25).

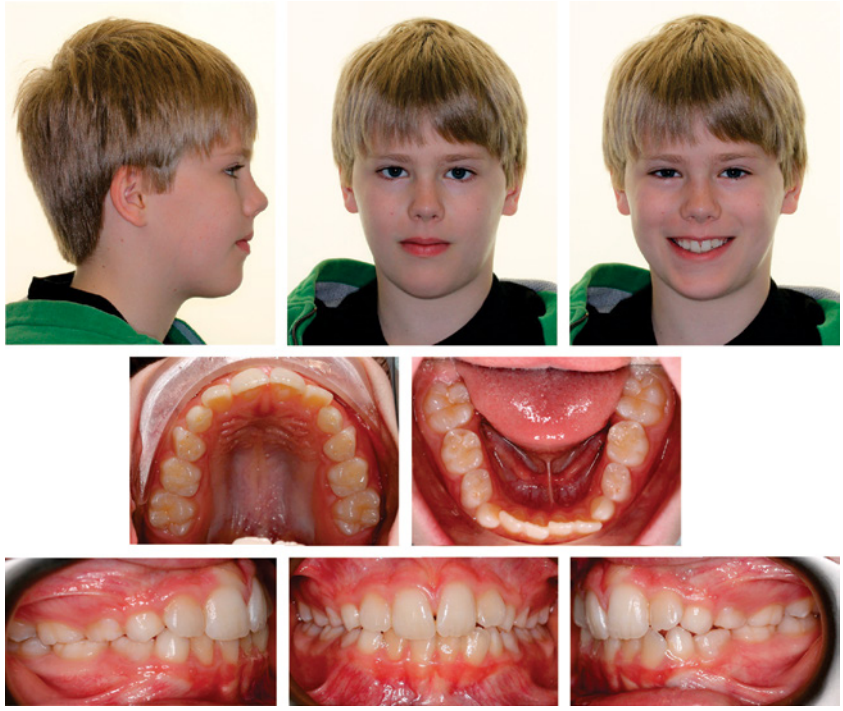


Figure 5.23 Patient One Initial Records.

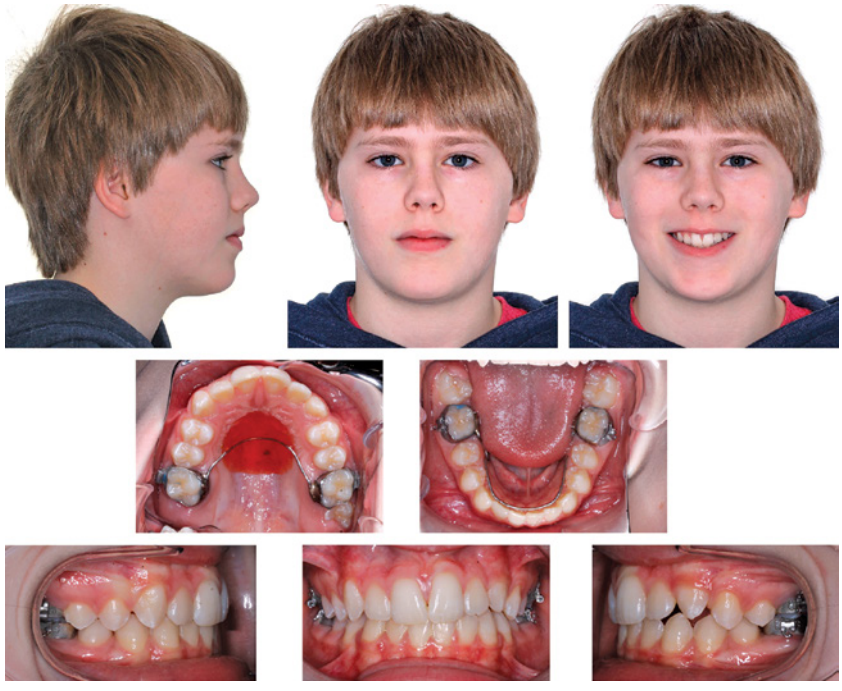
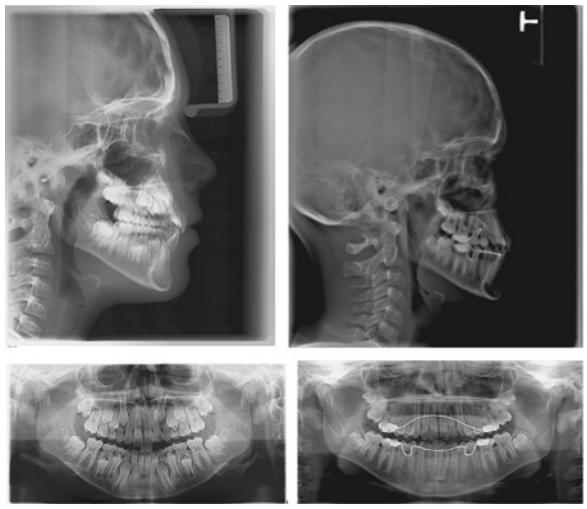


Figure 5.24 Nance Button and Lower Lingual Holding Arch.



	Norms	Pre	Post
SNA	82	82.9	84.0
SNB	80	80.4	81.5
ANB	2	2.5	2.5
WITS	–1.0	–2.1	–4.9
FMA	25	29.9	28.3
SN-GoGn	32	35.1	29.5
U1-SN	105	106.0	100.7
IMPA	95	84.8	83.6

Figure 5.25 Patient One Initial and Final Records.

Patient 2

This 9-year-old girl was brought to our clinic for evaluation as the family was concerned about the difference between the right and left sides of the maxillary arch (Figure 5.26). A simple Hawley appliance with an expansion screw and a finger spring was placed to correct

Figure 5.26 Patient Two Initial Records.

Figure 5.34

Figure 5.35

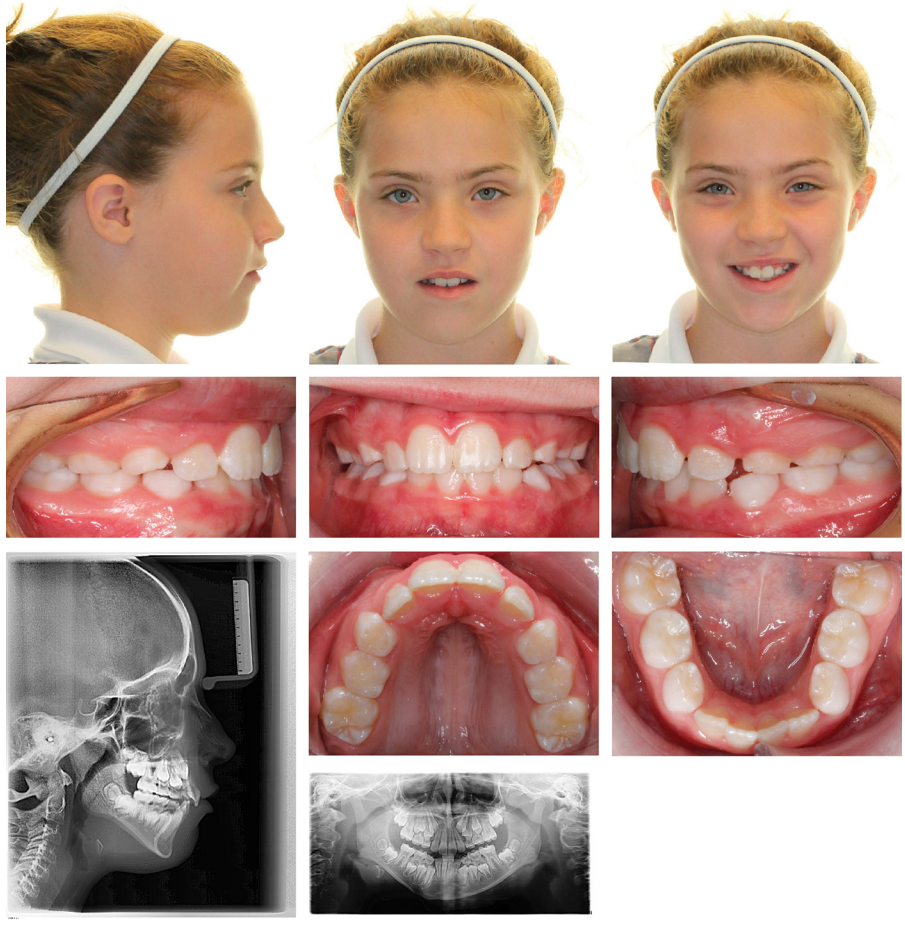


Figure 5.65

Figure 5.66

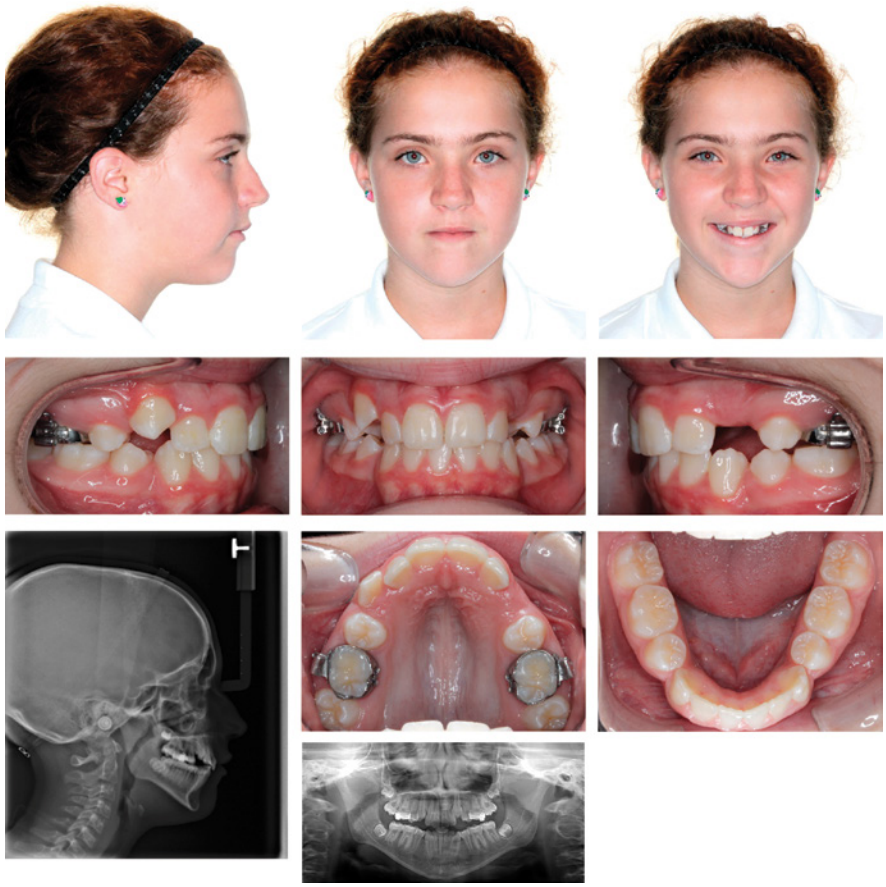


Figure 5.69

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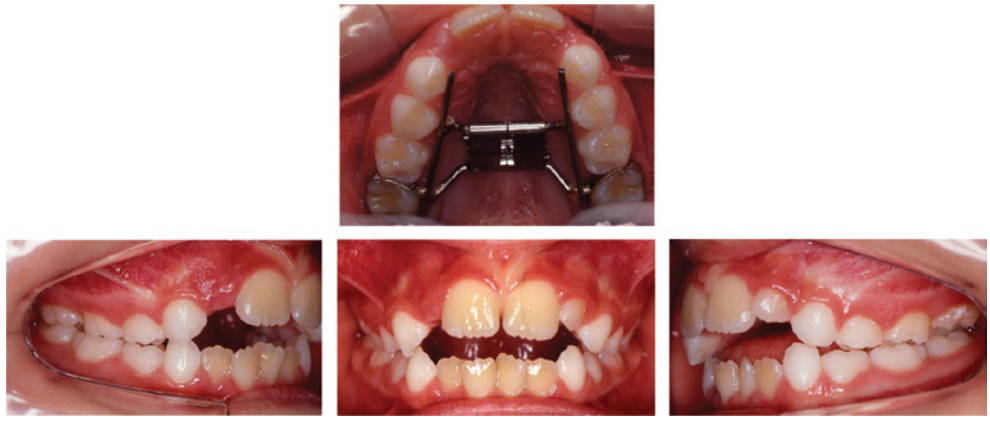


Figure 6.35

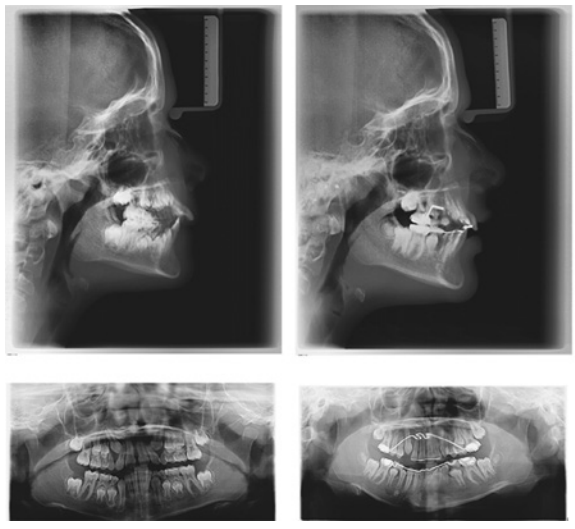
Figure 6.36

Figure 6.37

Figure 6.44

Figure 6.45

Figure 6.46



	Norms	Pre	Post
SNA	82	80.0	81.4
SNB	80	77.0	77.3
ANB	2	2.8	4.0
WITS	–1.0	–0.5	0.1
FMA	25	28.2	24.1
SN-GoGn	32	29.7	27.2
U1-SN	105	118.1	107.2
IMPA	95	90.3	98.3

Figure 6.47

Patient 2

This 12y 1m girl and her parents presented to our clinic referred by "the previous orthodontist for a possible nonsurgical procedure." She had a straight profile and a complete crossbite with the presence of a few deciduous teeth. A skeletal Class III was diagnosed, as demonstrated in the cephalometry. Initial records are shown in Figure 7.41.

After a thorough communication with the family, where we stressed the uncertainty of the prognosis and the possibility of a future surgical intervention, a treatment plan was presented. In the first stage, a palatal expansion and a protraction Hickham chincup were indicated. In 4 months, the maxilla was

	Norms	Pre	Post
SNA	82	79.0	80.0
SNB	80	82.3	81.0
ANB	2	–3.0	–1.0
WITS	–1.0	–7.0	–5.0
FMA	25	26.0	23.0
SN-GoGn	32	32.0	28.0
U1-SN	105	104.0	109.0
IMPA	95	89.0	84.0

Figure 7.41

expanded and positive overjet was obtained (Figure 7.42).

After the extractions of the remaining deciduous teeth, a new evaluation was done, and treatment proceeded with the extraction of the mandibular first molars. The rationale behind this extraction pattern was the uncertainty about her growth. Since the patient ruled out any surgical option, the decision to preserve the mandibular premolars was taken. The presence of good third molars was essential. Figure 7.43 shows the images after

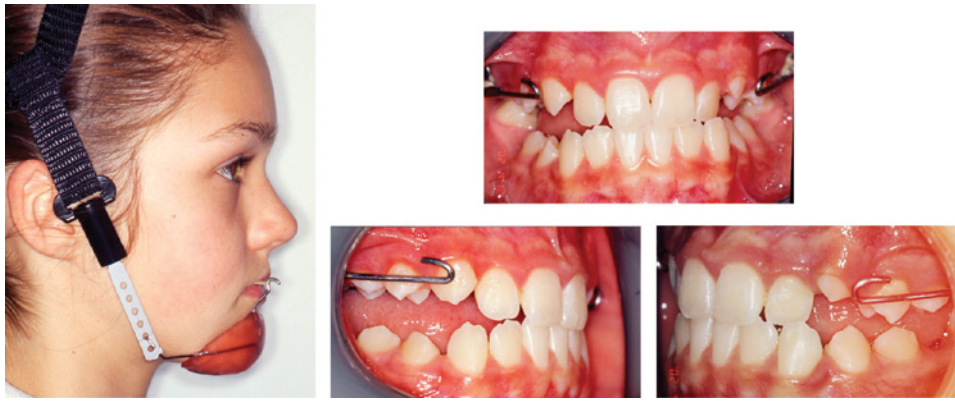
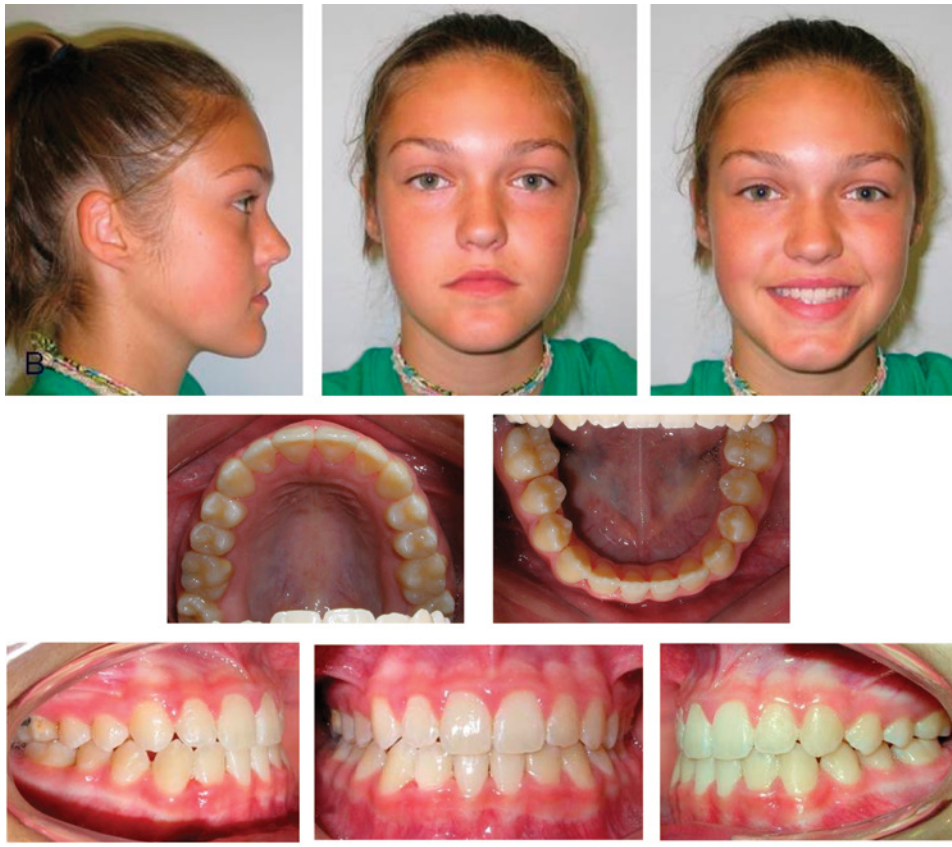


Figure 7.42

Figure 7.43

20 months of treatment, with all the spaces closed. Figure 7.44 illustrates the case at the end of treatment and Figure 7.45 illustrates the case at the 10 years posttreatment.



	Norms	Pre	Post
SNA	82	79.0	80.0
SNB	80	82.3	81.0
ANB	2	–3.0	–1.0
WITS	–1.0	–7.0	–5.0
FMA	25	26.0	23.0
SN-GoGn	32	32.0	28.0
U1-SN	105	104.0	109.0
IMPA	95	89.0	84.0

Figure 7.44

Figures 8.41–8.43 Class I mixed dentition crowded malocclusion with absent maxillary right second premolar. 8.41) Pretreatment. 8.42) After serial extraction of the maxillary right second primary molar and other first premolars. 8.43) Final.

Figure 8.42

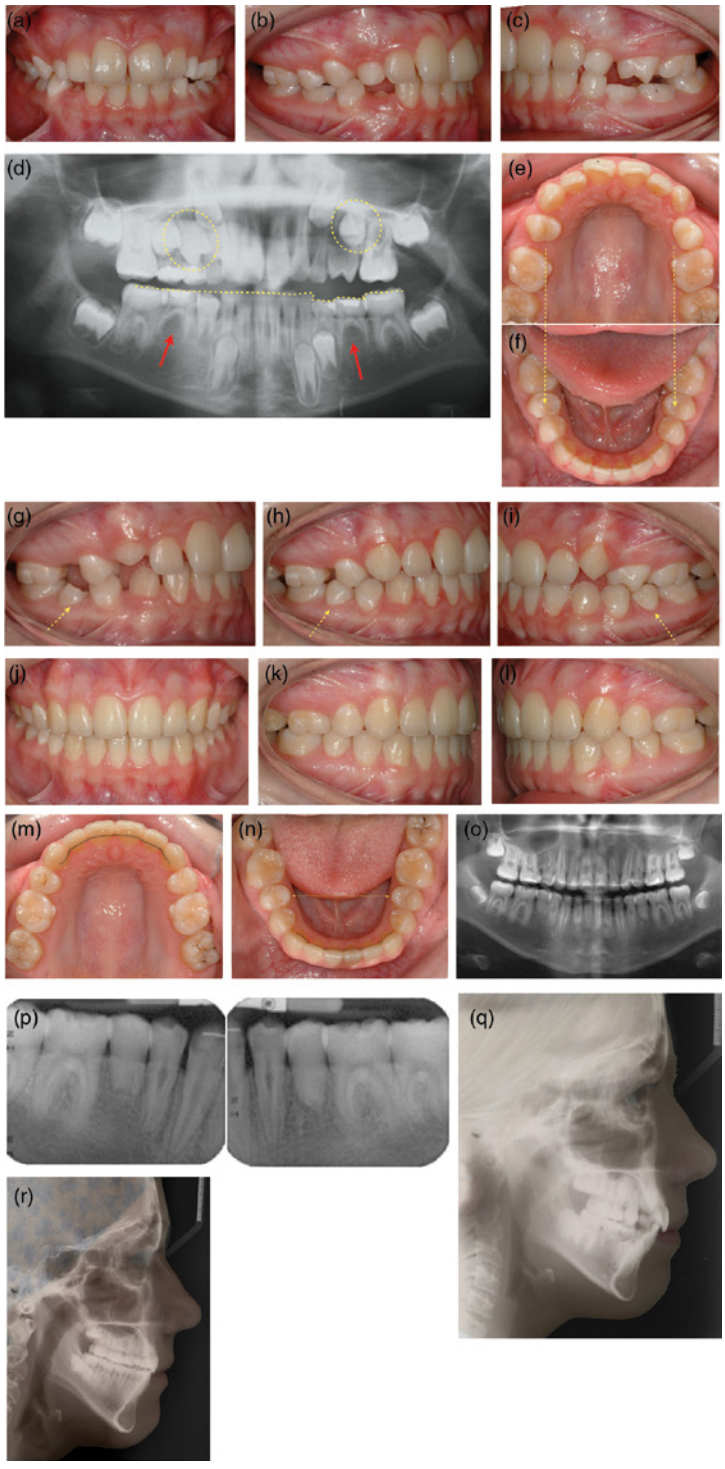


Figure 8.54 A 11y 5m girl was seeking orthodontic treatment (a–d). She had congenitally missing lower second premolars, detected on the panoramic radiograph (d, arrows). Infraocclusion of the primary molars on the left side was noted during her clinical examination. The patient's mother also had congenitally missing lower second premolars and she was concerned about the progressing infraocclusion of her daughter's teeth. Autotransplantation of unerupted upper second premolars (d, circles) was performed to replace missing teeth in the mandible (e, f, arrows). Eruption of the transplanted premolars and spontaneous correction of the dental relationships was seen after 12 months (g) and 18 months (h, i), when the orthodontic treatment was initiated. A stable occlusion and normal tooth contacts were present 1 year after debonding (j–n). No infraocclusion and hard tissue pathology was detected on the post-treatment radiographs (o, p). The patient's profile remained generally unchanged after the treatment (q: before the treatment, r: after the treatment).

Figure 8.69 (a–c) Records at decoronation.

Figure 8.70 (a, b) Records at decoronation.

Figure 8.71 One-month postdecoronation.

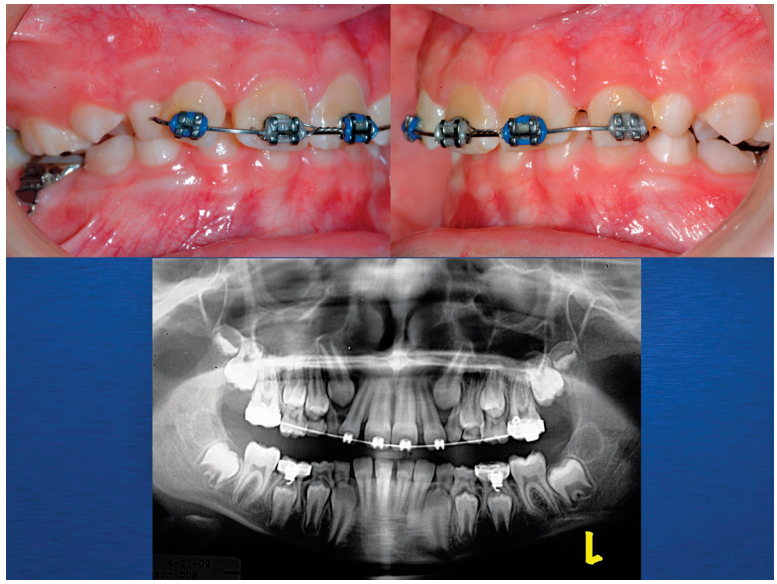


Figure 8.95 Mixed dentition root convergence. The maxillary centrals have "0" angulation. The maxillary laterals have been "switched" right to left and left to right, resulting in root convergence toward the midline.

Figure 8.96 Time 1 mixed dentition anterior alignment.

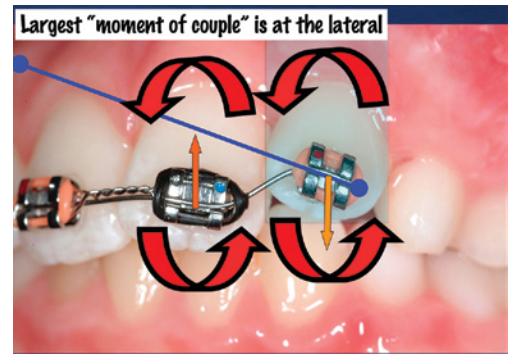


Figure 8.97 Time 1 mixed dentition anterior alignment using 0.012 nitinol wire anterior segment. Note additive moments of couples and reactive vertical forces.

of the arch wire until it is equal and opposite when the wire is placed over the two bracket slots before insertion (Figures 8.101–8.103).

8.39.12 Two brackets – two unequal oppositely directed couples

Figure 8.104 [1–3]

For clinical purposes, the effect of unequal and oppositely directed couples (subtractive) at two successive brackets may be thought of as the algebraic sum of the two single-bracket systems present. The relative magnitude of the moments at two successive teeth is approximated clinically by examining the wire passively placed over the two bracket slots. *The bracket with the larger angle of entry, and therefore the larger M_C, will have a greater tendency to rotate than the bracket with the smaller M_C.* When the directions of M_C at two successive brackets are unequal and in opposite