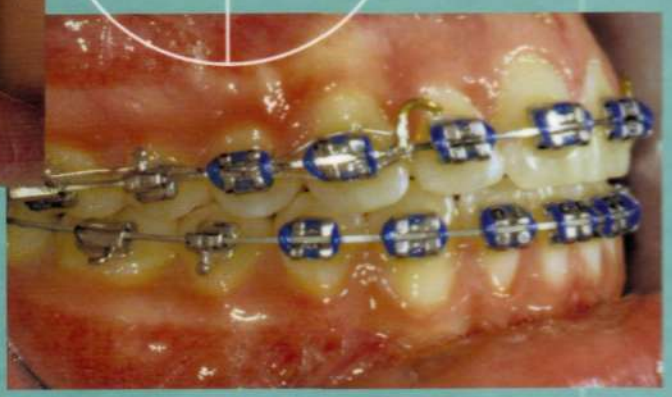
ORTHODONTIC MANAGEMENT OF UNCROWDED CLASS II DIVISION ONE MALOCCLUSION IN CHILDREN

A technique manual for treatment with the Andresen activator followed by preadjusted fixed appliances



JOHN C. BENNETT

MOSBY
ELSEVIER

ORTHODONTIC MANAGEMENT OF UNCROWDED CLASS II DIVISION 1 MALOCCLUSION IN CHILDREN

'What is important?'
'Culture. The acquainting ourselves with the best
that has been known and said in the world, and thus with the
history of the human spirit.'

MATTHEW ARNOLD, PREFACE TO LITERATURE AND DOGMA

Commissioning Editor: Michael Parkinson
Development Editor: Barbara Simmons
Project Manager: Frances Affleck
Designer: Stewart Larking

ORTHODONTIC MANAGEMENT OF UNCROWDED CLASS II DIVISION 1 MALOCCLUSION IN CHILDREN

JOHN C BENNETT
LONDON, UK

MOSBY

EDINBURGH LONDON NEW YORK OXFORD PHILADELPHIA ST LOUIS SYDNEY TORONTO 2006

ELSEVIER

Mosby
An affiliate of Elsevier Limited

First published 2006
ISBN-13: 07234 34263
ISBN-10: 9780723434269

British Library Cataloguing in **Publication Data**
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
A catalog record for this book is available from the Library of Congress

Notice
Knowledge and best practice in this field are constantly changing. As new research and experience broaden our knowledge, changes in practice, treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of the practitioner, relying on their own experience and knowledge of the patient, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions. To the fullest extent of the law, neither the Publisher nor the Author assumes any liability for any injury and/or damage to persons or property arising out or related to any use of the material contained in this book.

The Publisher

Typeset by IMH(Cartrif), Loanhead, Scotland
Printed in Spain

Preface

This was planned as a small book from the outset, and is about improving children's faces as part of orthodontic treatment. It is written in an informal style, to maintain interest, and is not intended as an extensive volume on the diagnosis and treatment of Class II malocclusion.

It shows a successful method of treating certain uncrowded Class 11/1 malocclusions, with advice on how to select suitable cases. This involves different thinking, because the conventional approach is to diagnose the case and then consider possible methods of treatment. Here, a well-proven treatment method is described, with answers to the question 'Is this case suitable?'.

Functional appliance treatment is a difficult topic to investigate, and has been studied for many years, but there is enough good research and clinical experience to determine the best way to treat our patients. This book sets out to recommend a 'best way', based on the publications of respected colleagues, many of them known personally to the author. Where possible there are references to support the treatment recommendations, but some material in this book is anecdotal, and based on many years of finding out what works and what does not.

The functional/fixed-appliance treatment method is well established, and can be the easiest route to an ideal outcome for many Class 11/1 patients. Consistently high-quality results are possible, but the cases need to be well managed, and good patient compliance is essential. The details are important.

Interestingly, this functional/fixed appliance approach seems to be particularly effective when treating male faces, perhaps because late and favorable mandibular growth occurs more often in boys than girls. Also, a Class II appearance can be an attractive female feature, and may be pleasing to some individuals, whereas the Class II look is less acceptable in boys, and correction may be more appreciated.

Even with the best treatment techniques, growth and patient cooperation can be limiting factors. Accordingly, there is a focus on methods of optimizing patient compliance, a topic which is often overlooked.

Most of the color illustrations are from scans of Ectochrome™ photographs of teeth, faces, and models, and there have been no digital changes of any sort to enhance the quality of the results. The radiographs were scanned in from film, and good X-ray hygiene was observed, with radiographs being taken only when they provided a clear treatment benefit for the child.

The text is written for rapid and easy uptake, with only a few treated cases and a handful of carefully chosen references. Many topics are well covered in other texts, and do not need a lengthy description, but where clinical precision is important, or where a new concept is involved, a full explanation is provided.

Sincere thanks are offered to European colleagues with whom I have discussed the Andresen appliance over many years. During the 1960s it was a privilege to treat hundreds of cases with Reginald Rix, who was an inspiring teacher and an expert in the use of the 'monobloc' as it was known. More recently, friends within the Angle Society of Europe have unselfishly offered advice from their vast experience, and from within the group particular mention should be made of Professors Hans Pancherz and Sabine Ruf, whose excellent research work has contributed so much scientific understanding about functional appliances. Their work is extensively cited in this book, as are the important publications of Professor Camilla Tulloch and her colleagues; she was a fellow postgraduate student in the 1970s at the Eastman in London.

An important role has been played by the children whose treatments are featured in this book. They cheerfully accepted the mirrors and lip retractors needed for the additional

photography, and the assistants in the Portland Place practice were unfailingly helpful with the extra work and documentation involved. Gry Garness used her considerable expertise to help manage the color images of the children's faces, and to prepare these for publication. All the Andresen appliances featured in this book were made by Mike Milnthorpe, and the excellent technical work from his London laboratory over many years is much appreciated. Concerning the actual writing of the book, it can be recorded that the original manuscript was created in Microsoft™ Office on an Apple™ Mac G5 running System 10.3. All the original line drawings were created by the author, using Macromedia™ Freehand MX.

Finally, mention should be made of the publishing process, which has changed so much since the first book was released in 1993. Although this is now the digital era, there still remains the same need for hard work, attention to detail, and friendly coordination of effort. In these areas the Mosby team has excelled. The energy and enthusiasm of Barbara Simmons, and the experience and advice of Michael Parkinson have been invaluable, as has the copy-editing wisdom of Lewis Derrick, the design flair of Stewart Larking and the typesetting skill of Ian Hunter. All these individuals contributed greatly, and they gracefully adapted to the author's sometimes unconventional work patterns, thereby enhancing the whole publishing experience.

John Bennett

March 2006

Contents

CHAPTER 1

An overview of the concept

QUESTION

Is this a reliable treatment method? If so, what are the advantages?

ANSWER

Yes, but as with other orthodontic treatment methods it requires correct timing, case selection, motivation, and appliance selection. There are two advantages. First, it is the easiest way for the patient and the orthodontist to achieve correction of certain malocclusions, because the Andresen appliance efficiently reduces the overjet, and then the fixed appliances are effective in finishing the case. Second, the treatment method releases mandibular growth if it is available, and allows an increase in lower face height in some low-angle cases, and then completes the treatment by tooth movement and dental compensation where necessary.

Orthodontists have used functional appliances for more than 100 years. During that time many designs have been tried. with a sometimes confusing array of names, and different claims have been made about what can be achieved.

Although devotees have suggested their use for other malocclusions, the mainstream use of functional appliances is in the treatment of Class 11/1 malocclusions in growing individuals. They have the capability to reduce an overjet and achieve a Class I dentition, which can then be finished with fixed appliances. Easy overjet reduction, without the use of fixed appliances or a headgear, remains a valuable treatment option for today's orthodontist. This method can be reliable and effective, but it requires correct timing, case selection, motivation, and appliance selection.

This book describes a functional/fixed method of treating uncrowded Class II division 1 malocclusions in adolescents. *Adolescence* may be defined as 'the period from puberty to adulthood in human beings'. *Puberty* may be defined as 'the stage of becoming physiologically capable of sexual reproduction, marked by genital maturation, development of secondary sex characteristics, and, in girls, the first occurrence of menstruation.

TWO TREATMENTS (EARLY AND LATE) OR ONE TREATMENT (LATE)?

Historically there have been two basic strategies commonly used in the treatment of Class II malocclusions in children,[1] and they can involve two treatments (early and late) or one treatment (late).

Two treatments (early and late)

A period of early treatment' in pre-adolescence at age 8-10 years is followed by a second period of definitive treatment during adolescence at age 11-14 years (Fig. 1.1).

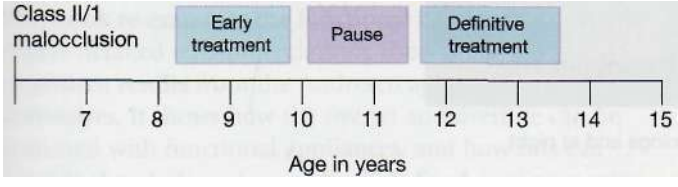
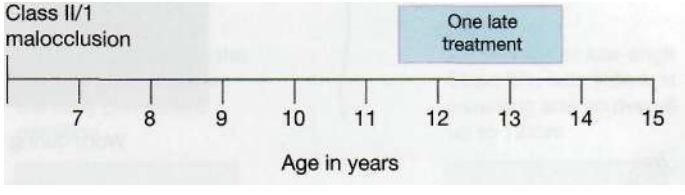


Fig. 1.1

One treatment (late)

The entire correction is accomplished in one treatment during adolescence, at age 11-14 years (Fig. 1.2), and this is the recommended strategy in Chapter 2.



This book describes and advocates the one treatment (late) approach for selected Class 11/1 malocclusions, commencing in early adolescence. The treatment involves a functional appliance stage immediately followed by a fixed-appliance stage. The entire correction is accomplished in one treatment, but in two stages which merge without a pause (Fig. 1.3), normally starting at age 11-13 years.

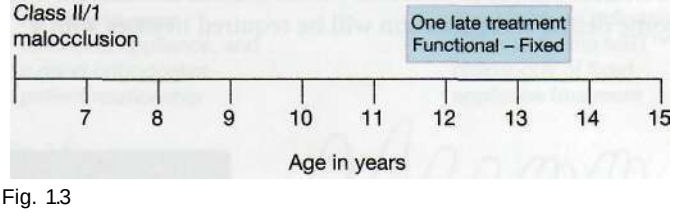


Fig. 1.3

The functional stage uses an Andresen type of appliance, and the fixed stage involves the use of the MBT™ system of metal fixed appliances to complete the treatment. Careful case selection is recommended, and the functional stage is timed to coincide with the loss of the last of the patient's primary teeth. This timing is intended to improve cooperation with the functional appliance and ensure an easy transition into the fixed stage, without a pause.

The functional stage

This typically lasts 6 to 9 months, and a functional appliance of the Andresen type is used to reduce the overjet and overbite (Fig. 1.4).

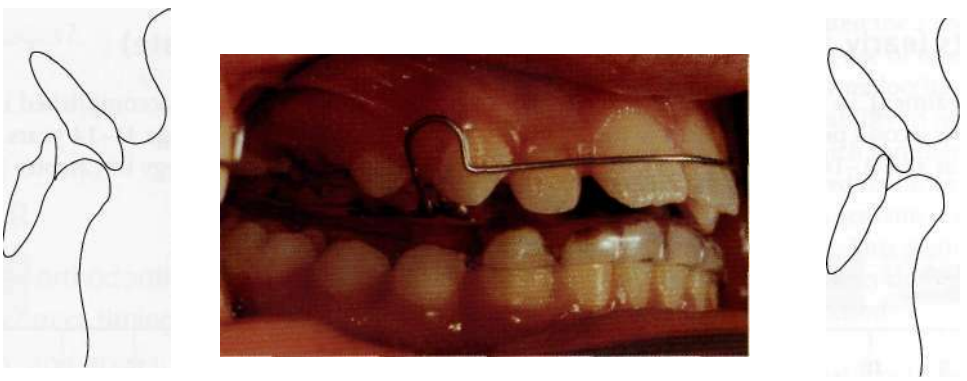


Fig. 1.4 The aim of the functional appliance stage is to achieve a near-normal relationship between the lips and the incisors.

The fixed-appliance stage

It typically takes 9 to 15 months to complete the treatment, and full-size metal MBT™ brackets are normally preferred (Fig. 1.5). For most cases the tip and in-out can be fully corrected. Torque is corrected within skeletal limitations, and some dental compensation will be required in cases with a Class II skeletal pattern. A positioner is sometimes helpful before normal retention. A near-ideal dentition, with the condyles centered in the fossae, is the aim of the fixed-appliance stage.[2]

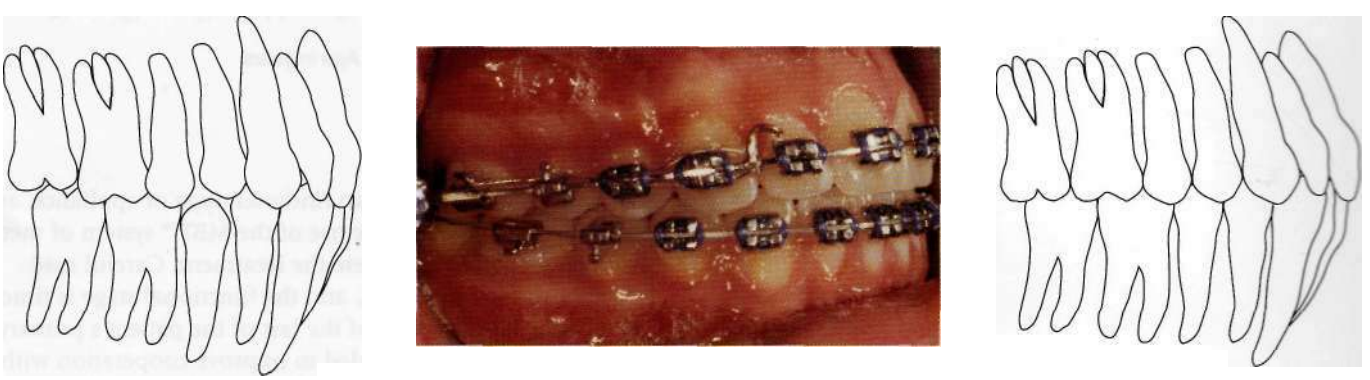


Fig. 1.5 The goal of the fixed-appliance stage is to achieve a near-ideal dentition, with the condyles centered in the fossae, within skeletal limitations

FUNCTIONAL/FIXED-APPLIANCE TREATMENT

Historically, functional appliances could have been more effectively used. Johnston[3] has noted that 'with more care, a better diagnosis, a more appropriate treatment plan, or greater technical expertise, better results could have been obtained with these appliances'. Although the literature reports inconsistent results from the combined functional-fixed method of treatment, consistent results can be achieved, but this requires a full mastery of the chosen functional appliance and correct case selection. Correct timing and good patient motivation are also needed.

This book re-examines the functional appliance arena, and makes detailed recommendations about how to obtain consistent results from the Andresen appliance and its derivatives. It shows how the overjet and overbite can be corrected with functional appliances, and how this can provide the platform for an effortless fixed-appliance stage. But all the details need to be right during the functional stage, and the timing needs to avoid a difficult pause between the functional and fixed-appliance stages. The treatment mechanics for the fixed-appliance stage are often easy, and have been described in a previous text, 'Systemized Orthodontic Treatment Mechanics'.[4]

FOUR FACTORS IN TREATMENT SUCCESS

The requirements for treatment success can be summarized into four areas of focus (Fig. 1.6). Each will be briefly discussed in this opening chapter, before going into more detail in later chapters:

1. The timing of treatment (details in Chapter 2).
2. Case selection (details in Chapter 3).
3. Patient compliance (details in Chapter 4).
4. Appliance selection (details in Chapters 5 and 6).

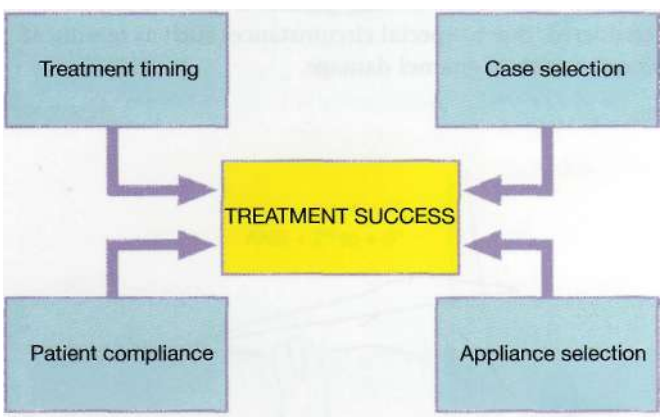


Fig. 1.6

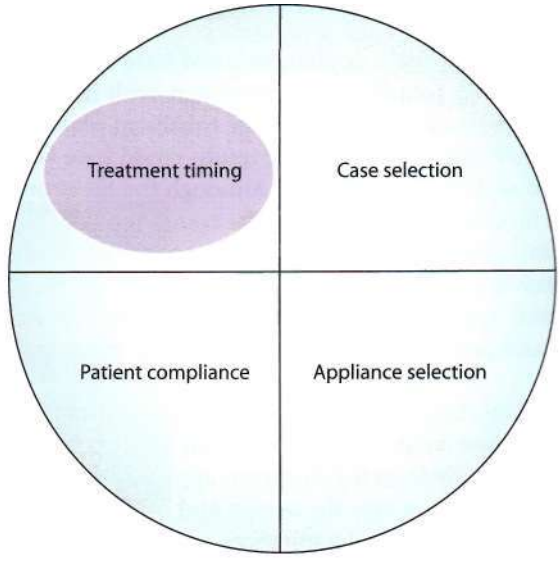
1. The timing of treatment

In Chapter 2 it is recommended to start in the late mixed or early permanent dentition, at dental age 11-12 years, with the entire correction being accomplished in one treatment.

From research evidence it is becoming clear that one late treatment is more efficient and involves shorter treatment times. Treatment is likely to be shorter (and the number of appliances used fewer) if treatment is started in the late mixed or early permanent dentition.

It is not logical to favor early treatment at age 8-10 years for growth reasons, because there is plenty of mandibular growth still available at age 11-13 years. The disadvantages of early treatment include prolonged treatment time, increased patient/parent 'burn-out', and a worse incidence of compromised treatment outcomes.

For a few individuals an early start to treatment can be considered, due to special circumstances such as teasing at school or risk of enamel damage.



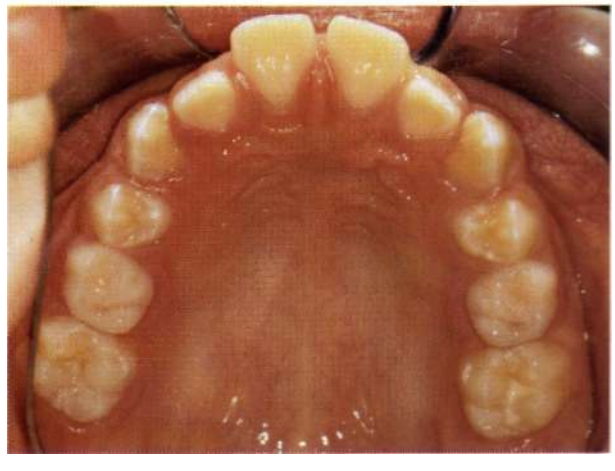


Fig. 1.8 Treatment is recommended to start in the late mixed or early permanent dentition. Treatment is likely to be shorter and the number *of* appliances used fewer.

2. Case selection

There is general consensus in the literature about this, and Chapter 3 makes five recommendations for selecting an ideal case for treatment with the Andresen appliance:

1. A Class 11/1 malocclusion with an increased overjet up to about 11 mm, and a deep overbite.
2. A horizontal skeletal pattern, which is Class I or mild Class II.
3. A vertical skeletal pattern, which is normal or hypodivergent.
4. Generally well-aligned dental arches, with little or no crowding.
5. A growing patient with a cooperative attitude.

In addition to the above, experienced Andresen users will often ask the child to protrude the mandible, to give a simulation of how the facial appearance would be if mandibular growth occurred. If it is possible to easily protrude the mandible in a comfortable way to achieve a normal overjet, and the profile looks good, this 'rule-of-thumb' suggests the case is suitable for Andresen treatment. It also shows improved facial balance to the child and parents, which is motivational in many cases.

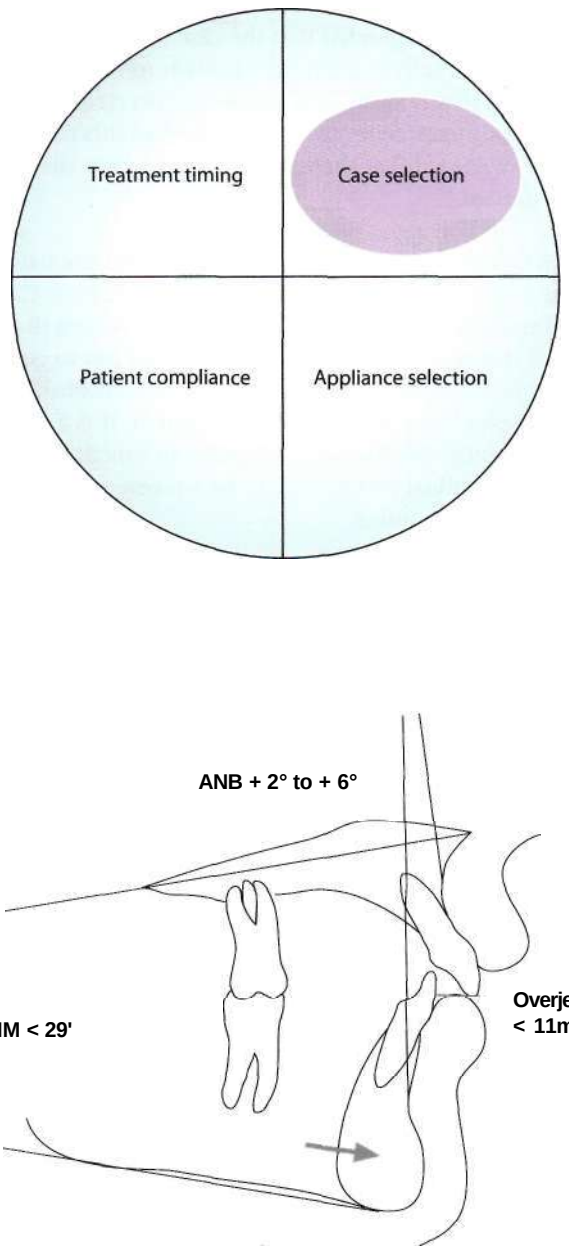


Fig. 1.10 Ideal case selection includes a growing patient with a compliant attitude, generally well-aligned arches, and little or no crowding.

3. Patient compliance

In Chapter 4 the subject of patient compliance is given high priority. It is recommended that the case presentation should be structured to fully explain the problem to the child and parents, and clearly show how it can be corrected. The advantages of treatment can be listed, and at this early stage it can be explained that there will be areas where cooperation will be needed.

There is evidence that the relationship between the patient and the orthodontist is all important in compliance. Careful appointment scheduling is therefore needed during the early stages of treatment, because the orthodontist has to convey commitment and build the patient-doctor relationship. This needs time and a considerate, caring manner. It is a common error to consider the fitting or adjusting of functional appliances as trivial procedures, to be squeezed into appointment scheduling.

Patient compliance is a challenge, and it is open to the orthodontist to motivate patients, giving them every reason to cooperate. This process starts at the case-presentation visit, and continues with encouragement throughout the treatment.

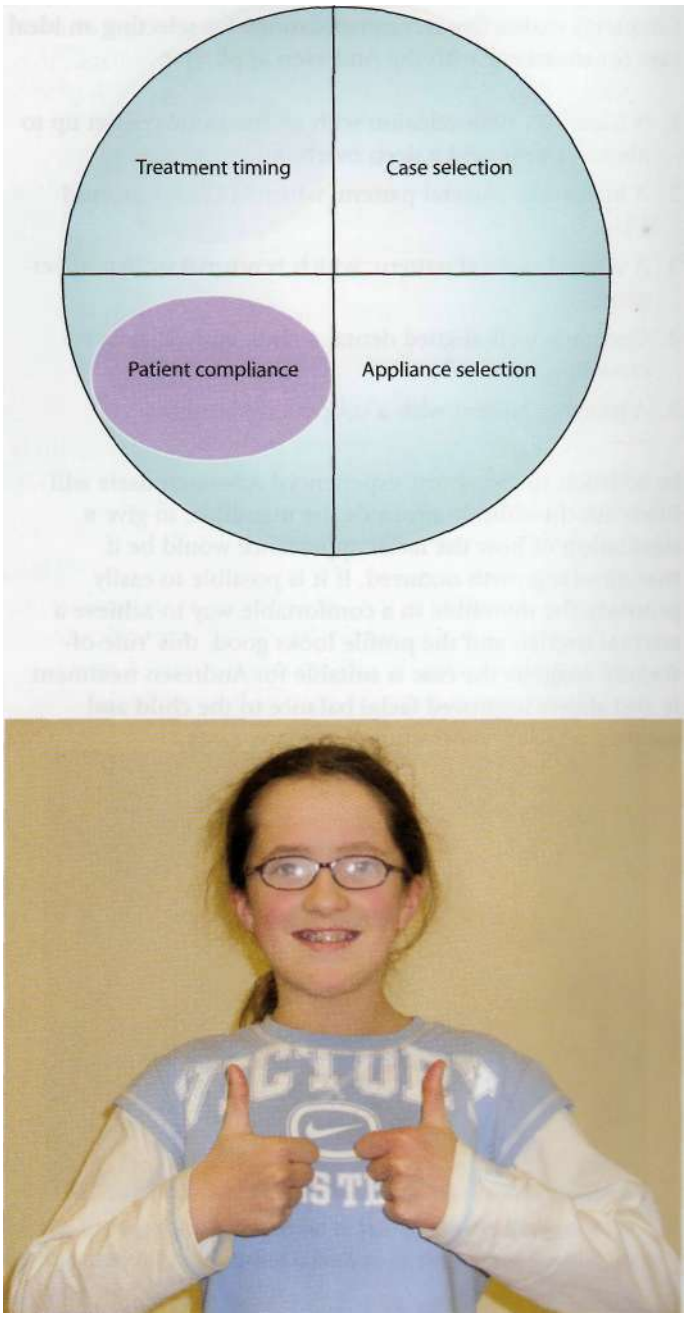


Fig. **1.12** Patient compliance is a challenge, and it is open to **the** orthodontist to motivate patients, giving them every reason to cooperate.

Appliance selection

Tee functional appliance is used at the start of treatment to reduce the overjet and overbite, and to achieve a near-normal incisor relationship. It is necessary to select an appliance that ell achieve these goals and which is easy for the patient to **wear.** In Chapter 5 the recommended design is the basic activator as described and used by Andresen, without the addition of a headgear or an expansion device. This is simple and robust, and easy to wear, so that cooperation is normally good. It is well accepted by the patients and there are few breakages. The design has the advantage that it allows eruption of lower molars, and an increase in lower face height, in low-angle cases.

For the fixed-appliance phase of treatment a system is needed that is well proven and has optimal tooth control. The aim is to correct any unwanted torque and tip which may have occurred in phase one, particularly torque, and then to achieve ideal finishing, within skeletal limitations.

In Chapter 6 the MBT™ system is described as an ideal choice for the fixed-appliance phase, because it has a specification that is uniquely effective in producing the tooth movements needed after functional appliances and it is capable of excellent finishing.

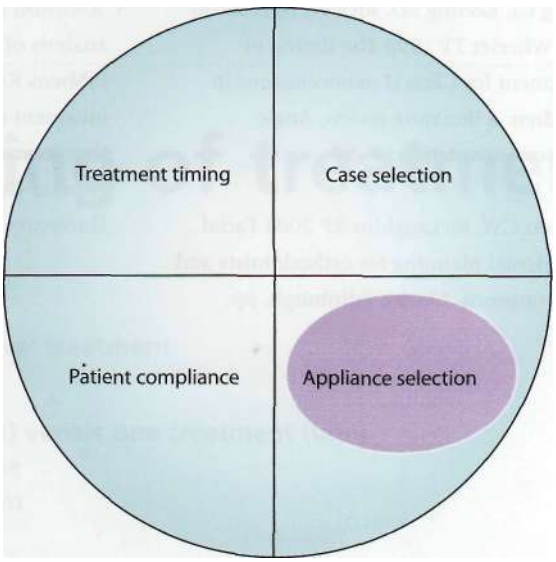


Fig. 1.14 The basic activator, as originally described by Andresen, is well accepted by the patient.

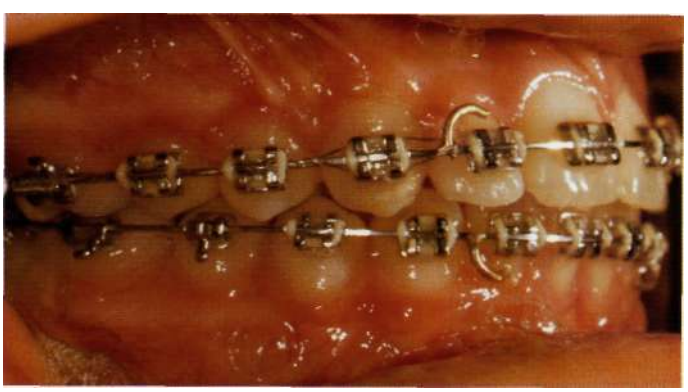


Fig. 1.15 The MBT™ system of fixed-appliance treatment is uniquely effective after functional appliances.

REFERENCES

1 King GJ, Keeling SD, Richard A, Hocevar RA, Wheeler IT 1990 The timing of treatment for Class II malocclusions in children: a literature review. Angle Orthodontist 60(2):87-97

2 Arnett GW, McLaughlin RP 2004 Facial and dental planning for orthodontists and oral surgeons. Mosby, Edinburgh, pp. 5-10

3 Johnston LE Jr 1986 A comparative analysis of Class II treatments. In: Vig PS, Ribbens KA (eds) Science and clinical judgment in orthodontics. Monograph 19, Craniofacial Growth Series, Center for Human Growth and Development, The University of Michigan, Ann Arbor

4 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh

CHAPTER 2

The timing of treatment

QUESTION

What is the optimal time to start, and why is it important?

ANSWER

Ideally there should be one treatment, starting in the late mixed dentition. There is still plenty of growth available at this age, and there is a mass of evidence that it is more efficient, with a shorter treatment time.

TERMINOLOGY

'Interceptive' or 'preventive' treatment

Where required, the clinical orthodontist will routinely provide minor treatments for some children in the mixed dentition. Such limited interventions may be described as 'interceptive' or 'preventive' treatment (Fig. 2.1). They normally have a limited duration and may include habit control or the use of passive appliances such as space maintainers. They may also involve minor alignment of incisors, and correction of simple anterior or posterior crossbites, to eliminate displacements. Interventions of this .type will not be described as 'early treatment' in this book.

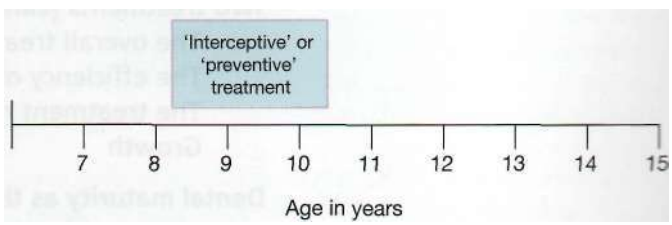


Fig. 2.1 Minor treatments in the mixed dentition may be described as 'interceptive' or 'preventive'.

'Early' treatment

'Early' Class II treatment may be defined as: 'The first treatment of a comprehensive correction of a Class II malocclusion, begun before adolescence, and designed to achieve Class II correction, with a second later treatment required for the completion of the case.'[1] This definition is derived from earlier work.[2] In this book the term 'early treatment' (Fig. 2.2) will refer to the first of two treatments (early and late).

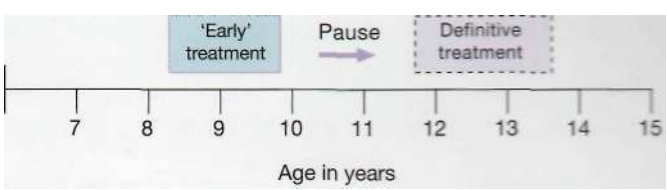


Fig. 2.2 'Early' treatment of Class II refers to the first of **two treatments.** early and late.

TWO TREATMENTS (EARLY AND LATE) VERSUS ONE TREATMENT (LATE)

The overall treatment time

It is not possible to complete a full course of orthodontic treatment before the premolars and second permanent molars have erupted at dental age 12 or 13 years. If treatment is started at age 11 years it can be completed at age 13 years (Fig. 2.3). However, if it is started at age 8 years, it still cannot be finished before dental age 12 or 13 years. Logically, individuals starting at age 8 years will be facing a longer treatment experience, with no evidence that the outcome will be any better.

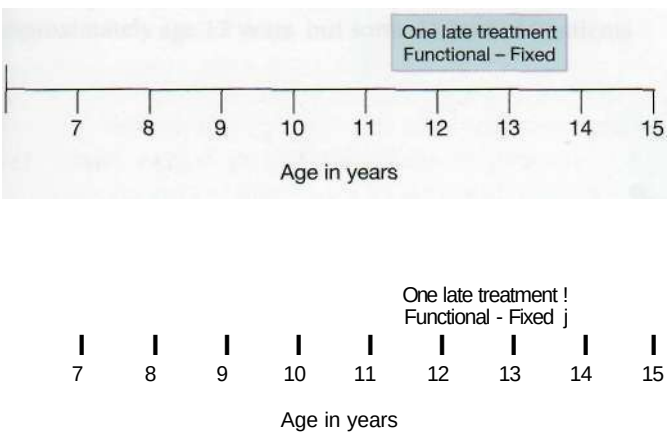


Fig. 2.3

Despite this, the 'early and late' treatment approach has been widely followed. For example, Gianelly estimated that in 1992 at least 300,000 American children were in an 'early and late' orthodontic program.[3] Publishing in 1995, he favored late treatment: 'If treatment is started in the late mixed dentition stage of development, at least 90% of all children with Class II malocclusions can be treated successfully in one phase, which lasts between 2 and 3 years' As more research evidence becomes available it is increasingly clear that late treatment is more efficient and involves shorter treatment times. For example, in 1999 Beckwith and coworkers, in a study of 140 consecutive cases, found that patients experiencing 'early and late' treatment spent significantly more time in active treatment.[4] In 2004 Trulsson[5] and coworkers published a study of the factors that affected the length of orthodontic treatment in 93 Swedish school children with increased overjets. They found that treatment was likely to be shorter, and the number of appliances used fewer, when treatment was started in the late mixed or early permanent dentition.

The efficiency of treatment

von Bremen and Pancherz[6] investigated the efficiency of early versus late Class II division 1 treatment in a group of 204 patients. Publishing in 2002, they concluded that: 'Treatment of Class II division 1 malocclusions is more efficient in the permanent dentition (late treatment) than it is in the mixed dentition (early treatment).'

In 2004 Tulloch and coworkers published the outcomes from an important 10-year study, conducted at the University of North Carolina.[7] They reported on 137 patients, in a prospective randomized trial designed specifically to examine the two major strategies used to treat Class II malocclusion. Their findings suggested that 'early and late' treatment started before adolescence in the mixed dentition might be no more clinically effective than one treatment started during adolescence in the early permanent dentition. They also noted that early treatment appeared to be less efficient because it produced no reduction in the average time with fixed appliances.

In 2005 Hsieh and coworkers[8] investigated 512 consecutive patients treated at the Indiana University School of Dentistry, and found that it was inefficient to start treatment in the mixed dentition with early-treatment objectives, or to start treatment before the age of 10 years in males or 10.5 years in females. The disadvantages of early treatment included prolonged treatment time, increased patient/parent 'burn-out,' and a worse incidence of compromised treatment outcomes.

The treatment results

It has not been possible to show any advantages from early treatment in terms of treatment outcome. The results from two-phase treatments seem to be no better than one-phase treatments. In material from the Chapel Hill study, Tulloch and coworkers concluded: ' ... for children with moderate to severe Class II problems, early treatment followed by later comprehensive treatment on average does not produce major differences in jaw relationship or dental occlusion, compared with late one phase treatment'.[9]

Bondevik[10] reported greater treatment success with increasing age of the patient. The mean age in the group with a satisfactory treatment result was 11.95 years, while the mean age in the unsatisfactory group was 10.87 years. This suggests that the treatment results were better with late-treated cases.

Growth

It is not logical to favor early treatment at age 8-10 years only for growth reasons, because there is plenty of mandibular growth still available at age 11-13 years (Fig. 2.4). Growth studies[11] give only average values for the amount, direction and timing of growth, but there is wide variation among individuals. As clinical orthodontists, we are dealing with individuals, and when we examine a child, it is not possible to predict growth for that individual accurately.

The literature tends to support the view that it is not logical to use growth as a basis for the timing of treatment. In 1997 Tulloch and coworkers[12] commented on the wide variation in growth seen in the untreated patients in their study, and stated that: 'There is little to be gained from precisely timing treatment to specific age/maturity markers.' They found that a favorable reduction in Class II skeletal problems can occur for patients in a broad range of skeletal severity and growth patterns.

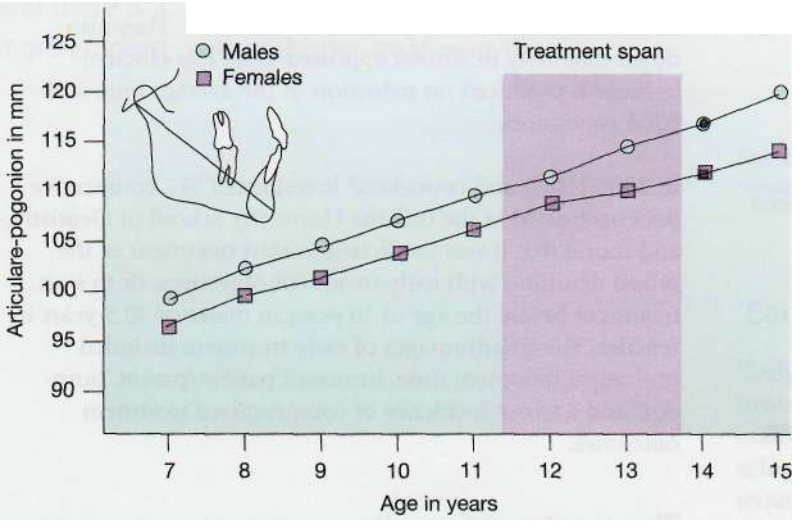


Fig. 2.4 Growth studies[11] confirm that there is plenty of mandibular growth available at age 11-13 years.

DENTAL MATURITY AS THE LOGICAL BASIS FOR TREATMENT TIMING

There are many advantages to one treatment, starting in the late mixed dentition or the early permanent dentition. In 1995 Gianelly[3] defined the late mixed dentition as: ' ... the stage of dental development identified by the exfoliation of all deciduous teeth except the deciduous second molars'

When planning the start of treatment it is helpful to avoid basing it on the patient's age, because the dental age is so often different from the chronological age. In discussions with the patient and parents it is better to explain the sound reasons for delaying treatment, and agree to start 'when most of the primary teeth have been shed.'

Normally, this method allows the Andresen to be fitted at approximately age 12 years, but some 11-year-old patients will show early dental development and will have lost all their deciduous teeth, so that treatment can be started without delay. Other patients will show late dental development and reach 13 years with a few deciduous teeth still present. For these individuals there can be a discussion about extracting the remaining deciduous teeth, so that the fitting of the functional appliance is not unduly delayed. Individual growth is unpredictable, but the growth studies[11] indicate that there should be plenty of growth available if the Andresen is fitted at any time between 11 and 13 years. It is normally possible to commence treatment for girls a little earlier than boys, because of earlier maturity (Fig. 2.6).

Fig. 2.5 There are advantages to providing correction as one treatment, starting in the late mixed dentition (center) or the early permanent dentition.

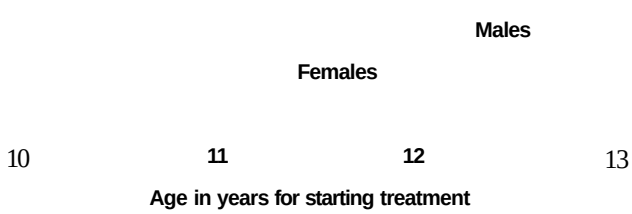


Fig. 2.6 If treatment is started when most of the primary teeth have been shed, **it** is normally possible to treat girls a little earlier than boys.

The need for the extraction of primary teeth

The late mixed dentition is an ideal time to start the functional stage for many patients. However, there may be a need to extract the primary second molars (Es) as the functional stage progresses, and this should be discussed and agreed with the patient and parents before commencing. As the Es become loose, it may be difficult to wear the Andresen at a time when full cooperation is needed. Also, some patients will achieve rapid progress with the Andresen, and reduce the overjet with one or two primary teeth still present. It will be necessary for any remaining deciduous teeth to be extracted so that the fixed stage can be started without a pause.

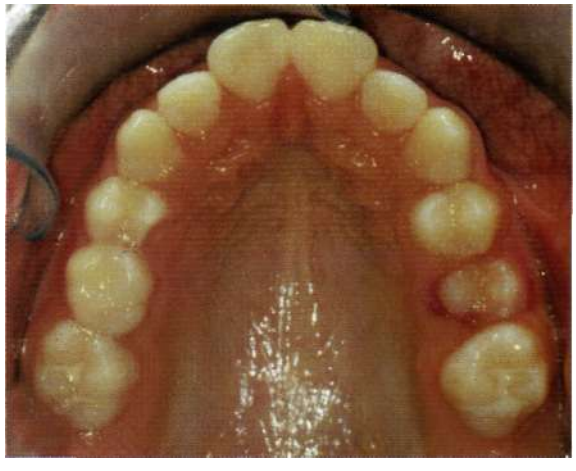


Fig. 2.7 It may be necessary to extract the remaining primary teeth as the functional stage progresses. If primary teeth are present after overjet reduction is complete it is often necessary to extract them to allow the fixed-appliance stage to commence.

Schmuth[13] has commented that: 'During the mixed dentition period, erupting teeth may jeopardize compliance.' Disruption to appliance wear, caused by shedding of primary teeth (Fig. 2.7), is a major reason to avoid starting in the early mixed dentition.

Treatment is often started in the late mixed dentition, but with the understanding that it may be necessary to extract the Es as treatment progresses.

CASES WHERE EARLY OVERJET REDUCTION MAY BE INDICATED

For a few individuals an early start to treatment can be beneficial, due to special circumstances. However, if a decision is made to provide early treatment, there will be a probability of a longer overall treatment time, and the family should be informed about this. Possible special reasons include teasing at school and risk of enamel damage.

Early overjet reduction for social or psychological reasons

At the first appointment it is necessary to evaluate younger patients with increased overjets carefully, and enquire whether they are being teased about their teeth, because malocclusion is known to carry a psychosocial stigma.[14 ls] Shaw and coworkers[14] interviewed 531 school children aged between 9 and 13 years. Seven percent of this sample reported that they were teased about their teeth once a week or more, with teeth being the fourth most common target after height, weight and hair. Half of the 7% were teased due to the prominence of their upper incisors, with expressions like 'Goofy,' 'Bugs Bunny' and 'Stickyout Teeth' (Fig. 2.8).

In a study on the effects of facial deformity, MacGregor[17] suggested that malocclusions may also cause children considerable anxiety. Surprisingly, individuals with milder forms of facial disfigurement, such as malocclusion, suffered more psychological distress than those with greater deformity. It was felt that those with milder problems had not developed protective mechanisms, and they were therefore in a constant state of anxiety in social interactions, because episodes of ridicule were inconsistent and unpredictable.

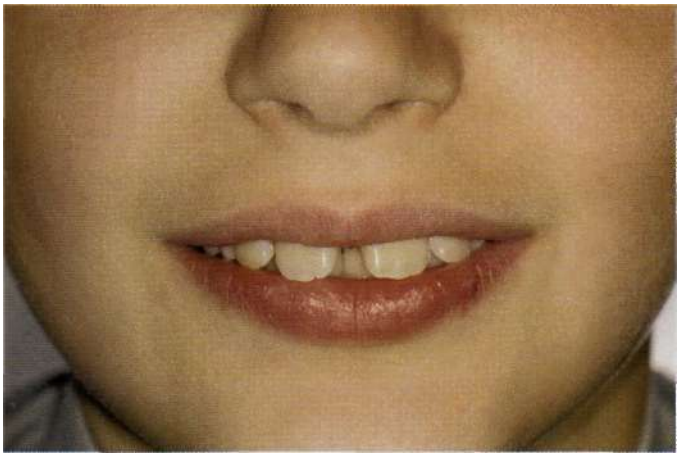


Fig. 2.8 Seven percent of children reported that they were teased about their teeth once a week or more, with expressions like 'Goofy,' 'Bugs Bunny,' and 'Stickyout Teeth.'

Against this background, for each individual it is necessary for the clinician to decide whether the levels of teasing or other psychological distress are sufficient to justify the disadvantages of an early start to treatment.

Early overjet reduction to reduce the risk of enamel damage

Incisor trauma is a significant problem among children and adolescents. Studies in the 1960s and 1970s established that an increased overjet brings a greater risk of enamel damage to the upper incisors,[18-20] and it is noteworthy that three of the cases in this book suffered upper incisor damage. A recently published study of 1583 Kuwaiti children[21] concluded that the risk increased by 13% for every additional millimeter of overjet, and confirmed the findings of other workers that the risk was twice as great in boys as in girls. It was found that 63% of the injuries occurred at age 10 years or older, and most of the traumatized teeth were upper central incisors (Fig. 2.9).

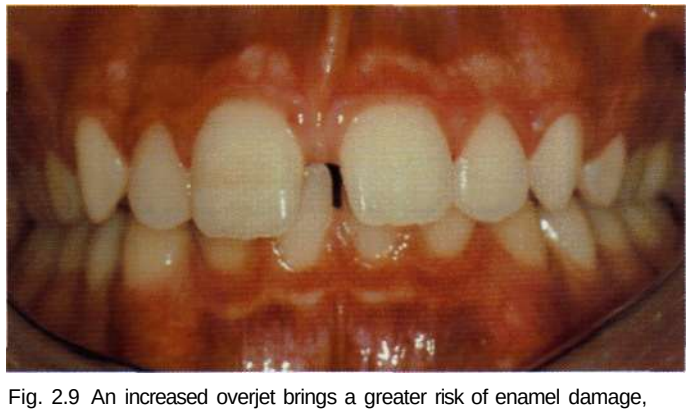


Fig. 2.9 An increased overjet brings a greater risk of enamel damage, mainly to the upper central incisors.

The patient and family should be informed about the risk of incisor trauma associated with increased overjet, and can be involved in the decision making. However, many clinicians will doubt whether the hazard is sufficient reason to start early treatment, because there is no guarantee that early overjet correction will prevent damage to the incisor enamel. If it is decided not to provide early treatment, the situation can be carefully explained to the child, with advice to try not to damage the upper incisors 'until they can be straightened.'

THE USE OF FUNCTIONAL APPLIANCES IN LATE ADOLESCENCE

The original Oslo teaching concept was based on the belief that the function determines how the skeletal development will be. 'If you can change the function, you can change the development' (page 56). Logically, if abnormal lip function has been allowed to continue too far into adolescence, this will limit what can be achieved.

By the mid-teens the lips will have assumed mature function around the established Class 11/1 incisor relationship, and it is therefore less effective to use a treatment approach based on an Andresen appliance immediately followed by fixed appliances. Tooth movements may be achieved, but there will be little growth to come and the abnormal lip function will be less responsive to change. Accordingly, the patient will be too old to obtain an optimal facial improvement from the functional/fixed method, and orthognathic surgery should be considered if facial improvement is the main reason for seeking treatment.[22]

There is a wide range of maturity levels among teenagers, and it can be difficult to decide if a patient is too old. For example, some 14 year olds may be less mature dentally and physically, with second molars just erupting and significant growth to come. Other 14 year olds may show signs of adulthood, with second molars that have been in the mouth for more than two years, and the clinician needs to make judgments on a case-by-case basis.

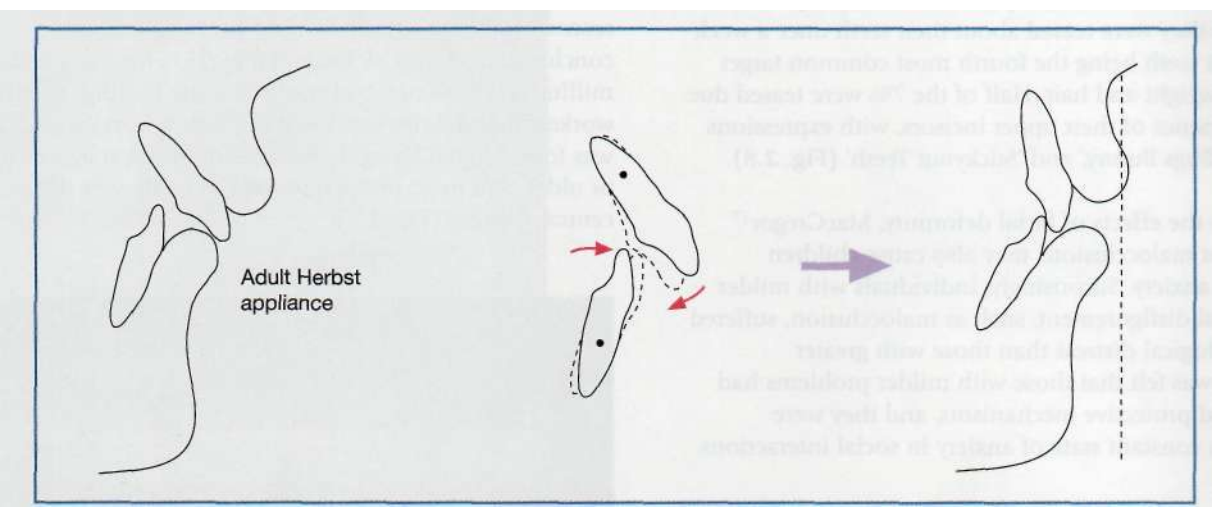


Fig. 2.10 It has been shown[22] that the Herbst appliance can be effective in reducing overjets for non-growing individuals, with the correction being achieved mainly by dental change.

For Class 11/1 cases aged 15 years or older, any change from orthodontic appliances alone is likely to be due mainly to tooth movements, with limited facial improvement. This view is supported by the 2004 paper of Ruf and Pancherz.[22] Reviewing a group of 69 Class II division 1 adults in the age range 15.7 years to 47.6 years, they compared the outcome of orthodontic/orthognathic surgery treatment versus Herbst functional/fixed appliance treatment. All were well treated to a Class 1 result, but it was noted that in the surgical group the sagittal correction was achieved by skeletal more than dental changes. In contrast, the correction of the Herbst group was mainly by dental changes **(Fig. 2.10).** They concluded that the Herbst is a 'powerful tool for non-surgical, non-extraction adult Class II division 1 malocclusions,' but added that 'if the patient's main wish is a greatly improved facial profile, orthognathic surgery is a better treatment alternative (Fig. 2.11).'

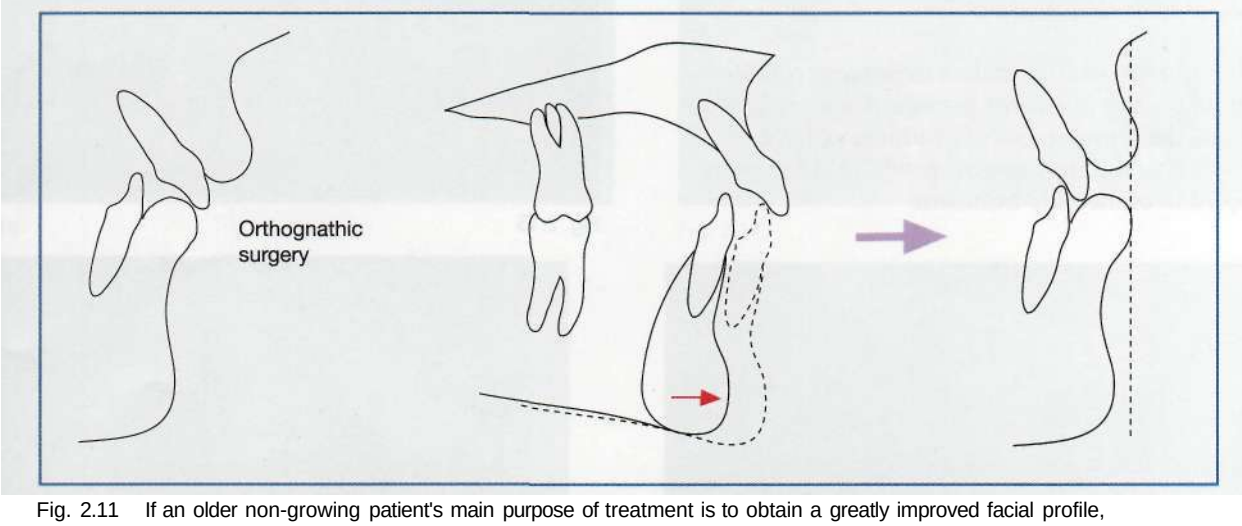


Fig. 2.11 If an older non-growing patient's main purpose of treatment is to obtain a greatly improved facial profile, orthognathic surgery is a better treatment alternative than a Herbst or other functional appliance.

CASETE

A male patient aged 10 years and 6 months at the start of treatment with a Class II division 1 malocclusion on a low angle pattern, with MM angle of 19 degrees. Skeletally the case was Class I based on ANB of 4 degrees but had a Wits of 4 mm, indicating mild Class II bases. A metal marker was placed on an upper central incisor prior to radiographs, to assist in analysis. There was typical proclination of upper incisors and retroclination of lower incisors, with abnormal position of the lower lip, resting behind the upper incisors.

Dentally, the patient showed a typical Class II division 1 malocclusion with an overjet of 11.5 mm and a Class II buccal occlusion. There was slightly late dental development, with 12 primary teeth present, and a notable upper midline diastema, with unsightly splaying of the upper incisors, which had led to teasing at school.

The family requested early treatment to improve confidence and to reduce the risk of enamel damage. It was explained that a second, definitive, course of treatment would be required, which would start approximately 12-18 months after completion of the early treatment.

Fig. 2.12

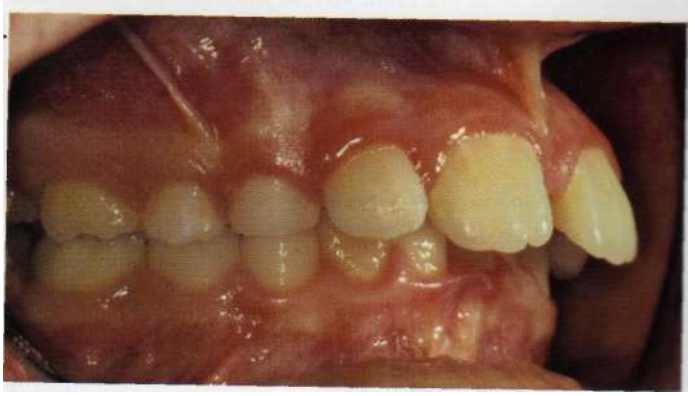


Fig. 2.15

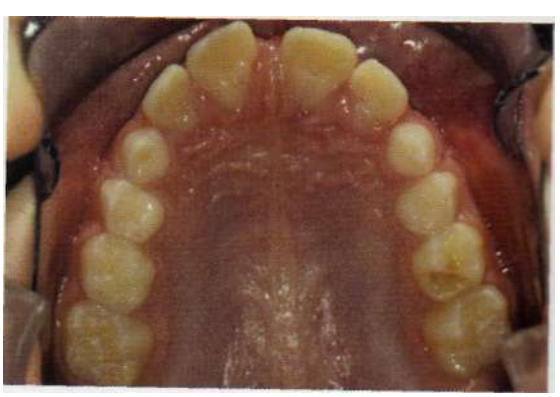


Fig. 2.18

Fig. 2.21

Case TE age 9.6

SNA	84°
SNB	80°
ANB	4°
Wits	4 mm
MM	19°
U1 to Max plane	124°
L1 to Mand plane	86°

Fig. 2.22

Fig. 2.13

Fig. 2.14

2.16

Fig. 2.17

Fig. 2.19

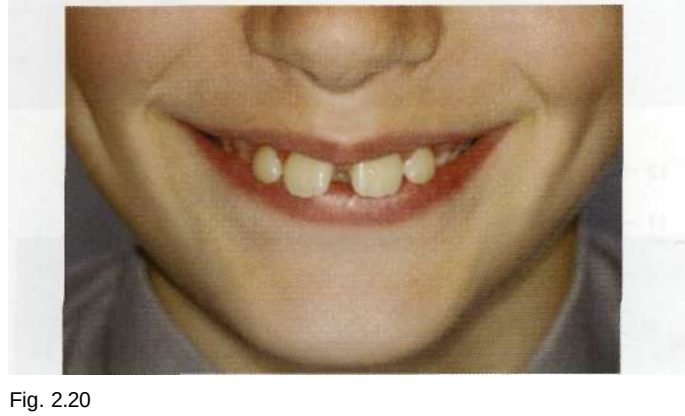


Fig. 2.20

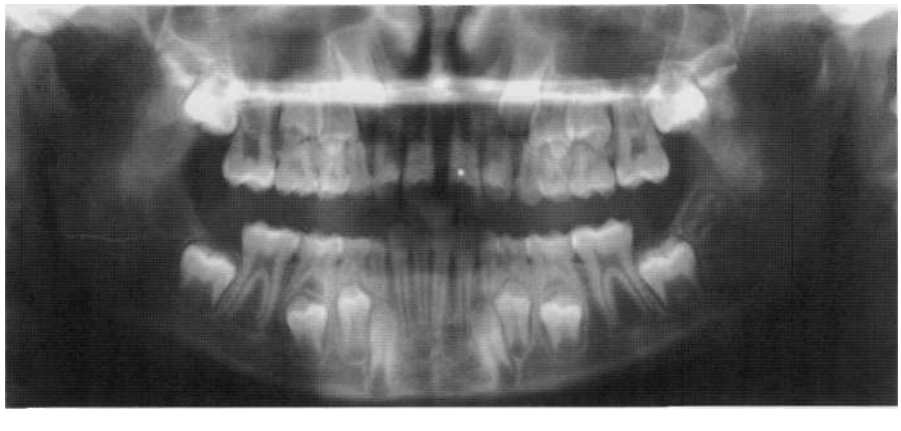


Fig. 2.23

The first Andresen was constructed using a wax bite with the mandible protruded approximately 6 mm and was worn for 6 months (Figs 2.24 & 2.25). A second appliance was then supplied, constructed from a wax bite with the mandible protruded to an edge-to-edge incisal relationship (Fig. 2.26). and this was used for a further 4 months to fully reduce the overjet (Figs 2.31, 2.32, 2.33 & 2.34).

The first Andresen reduced the overjet from 11.5 mm to 7 mm, and the second appliance reduced it to 4 mm (Fig. 2.34). After this the patient was asked to wear the appliance during sleeping hours only for 3 months. A normal lip-seal could easily be maintained and confidence was greatly improved. The patient was encouraged to maintain a lip seal. A pleasing improvement in facial harmony was achieved (Figs 2.28, 2.29 & 2.30) compared with the pre-treatment profile (Fig. 2.27).

The treatment was completed 10 months before this book went to press and during this time the incisor relationship remained stable. Radiographs were not taken after overjet correction as these would have been of no benefit to the patient. Arrangements will be made for a definitive course of treatment to be provided, starting at the late mixed dentition stage, and a full set of orthodontic records will be required prior to further treatment.

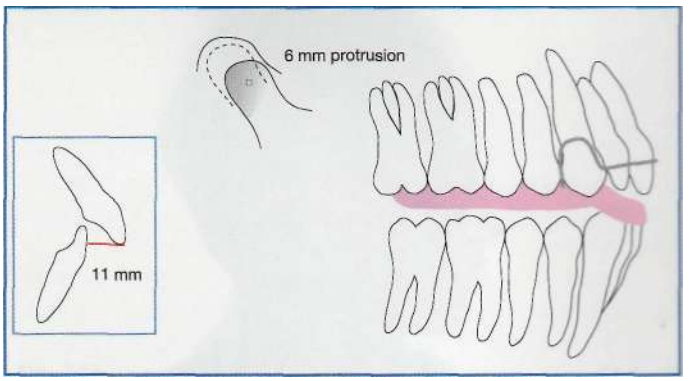


Fig. 2.24

Fig. 2.27

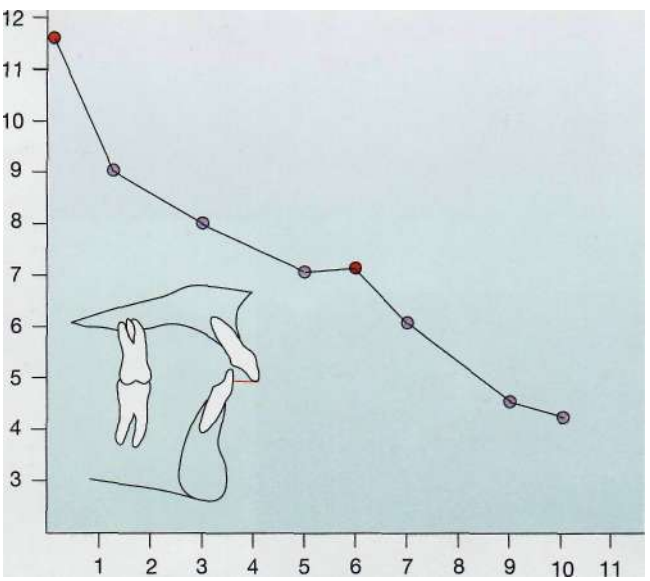
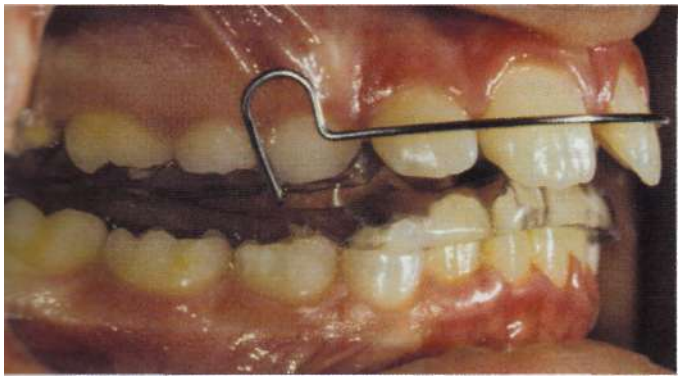


Fig. 2.31

Fig. 2.32



2.25

Fig. 2.26

Fig. 2.28

Fig. 2.29

Fig. 2.30

2.33

Fig. 2.34

REFERENCES

1 King GJ, Keeling SD, Richard A, Hocevar RA, Wheeler TT 1990 The timing of treatment for Class II malocclusions in children: a literature review. Angle Orthodontist 60(2):87-97

2 Ackerman JL, Proffitt WR 1980 Preventive and interceptive orthodontics: a strong theory proves weak in practice. Angle Orthodontist 50:75-87

3 Gianelly AA 1995 One phase versus two phase treatment. American Journal of Orthodontics and Dentofacial Orthopedics 108:556-559

4 Beckwith FR, Ackerman RJ, Cobb MC, Tira DE 1999 An evaluation of factors affecting the duration of orthodontic treatment. American Journal of Orthodontics and Dentofacial Orthopedics 115:439-447

5 Trulsson U, Lindav L, Mohlin B, Strandmark M 2004 Age dependence of compliance with orthodontic treatment in children with large overjet. An interview study. Swedish Dental Journal 28:101-109

6 von Bremen J, Pancherz H 2002 Efficiency of early and late Class II division 1 treatment. American Journal of Orthodontics and Dentofacial Orthopedics 121:31-37

7 Tulloch JF, Proffit WR, Phillips C 2004 Outcomes in a 2-phase randomized clinical trial of early Class II treatment. American Journal of Orthodontics and Dentofacial Orthopedics 125:657-667

8 Hsieh TJ, Pinskaya Y, Roberts WE 2005 Assessment of orthodontic treatment outcomes: early treatment versus late treatment. Angle Orthodontist 75:162-170

9 Tulloch JF, Phillips C, Proffit WR 1998 Benefit of early Class II treatment: progress report of a two phase randomized clinical trial. American Journal of Orthodontics and Dentofacial Orthopedics 113:62-72

10 Bondevik O 1995 Treatment needs following activator-headgear therapy. Angle Orthodontist 65(6):417-422

11 Riolo M, Moyers RE, McNamara JA, Hunter WS 1974 An atlas of craniofacial growth. The Center for Human Growth and Development, University of Michigan

12 Tulloch JF, Proffit WR, Phillips C 1997 Influences on the outcome of early treatment for Class II malocclusion. American Journal of Orthodontics and Dentofacial Orthopedics 111:533-542

13 Schmuth 1999 Considerations of functional aspects in dentofacial orthopedics and orthodontics. American Journal of Orthodontics and Dentofacial Orthopedics 115:373-383

14 Shaw WC, Meek SC, Jones DS 1980 Nicknames, teasing, harassment and the salience of dental features among schoolchildren. British Journal of Orthodontics 7:75-80

15 Brown DF, Spencer AJ, Tolliday PD 1987 Social and psychological factors associated with adolescents' self-acceptance of occlusal condition. Community Dentistry and Oral Epidemiology 15:70-73

16 Helm S, Kreiborg S, Solow B 1985 Psychosocial implications of malocclusion. A 15-year follow-up study in 30-year-old Danes. American Journal of Orthodontics and Dentofacial Orthopedics 87:110-118

17 MacGregor FC 1970 Social and psychological implications of dentofacial disfigurement. Angle Orthodontist 40:231-233

18 McEwen JD, McHugh WD, Hitchin AD 1967 Fractured maxillary central incisors and incisal relationships. Journal of Dental Research 46:1290

19 O'Mullane DM 1973 Some factors predisposing to injuries of permanent incisors in school children. British Dental Journal 134:328-332

20 Jarvinen S 1978 Incisal overjet and traumatic injuries to upper permanent incisors. A retrospective study. Acta Odontologica Scandinavica 36:359-362

21 Artun J, Behbahani AJ, Al-Jame B, Kerosuo H 2005 Incisor trauma in an adolescent Arab population: prevalence, severity, and occlusal risk factors. American Journal of Orthodontics and Dentofacial Orthopedics 128:347-352

22 Ruf S, Pancherz H 2004 Orthognathic surgery and dentofacial orthopedics in adult Class II Division 1 treatment: mandibular split osteotomy versus Herbst appliance. American Journal of Orthodontics and Dentofacial Orthopedics 126:140-152

CHAPTER 3

Case selection

QUESTION

What are the essentials for case selection for the Andresen appliance?

ANSWER

The ideal Class 11/1 case will be average or low angle, with little or no crowding and an overjet up to 11 mm. The patient will be compliant and growing. The appliance seems particularly effective for boys with a low angle over-closed skeletal pattern.

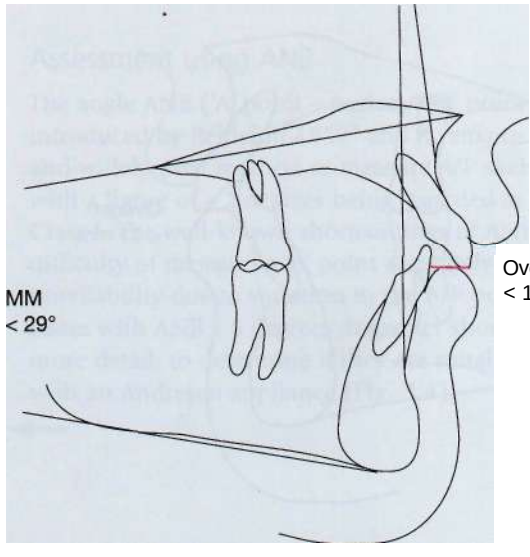
The Andresen appliance has been successfully used by generations of orthodontists. It is generally accepted that a certain type of Class 11/1 malocclusion responds well, but that other cases are better treated by another method. Selection is therefore important.

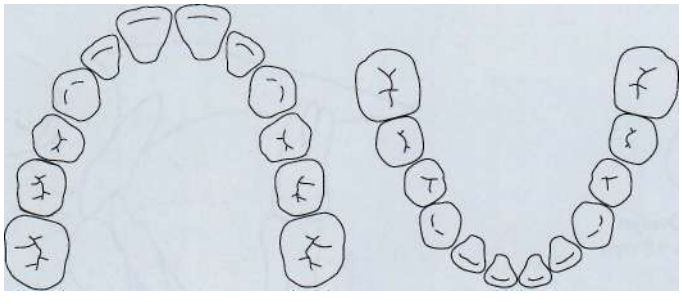
THE FIVE MAIN CONSIDERATIONS IN CASE SELECTION

The literature[1,2] and clinical experience suggest that there are five main considerations when selecting an ideal case for treatment with the Andresen appliance followed by fixed appliances (Fig. 3.1), and each is discussed in turn later in this chapter.

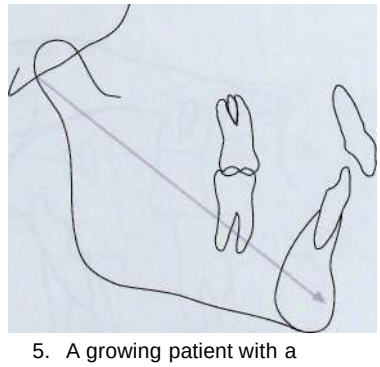
It should be remembered that these are general guidelines. If a case has features that fall outside one or two of the five general criteria for case selection, it may respond well to an Andresen appliance. However, as a general rule, if the case does not fit into the five broad guidelines it is probably better to treat it by an alternative method.

1. A Class 1/1 malocclusion with an increased overjet up to about 11 mm, and a deep overbite
2. A horizontal skeletal pattern that is Class I or mild Class II
3. A vertical skeletal pattern that is normal or hypodivergent





4. Generally well-aligned dental arches, with little or no crowding



5. A growing patient with a cooperative attitude

Fig. 3.1 The five main considerations in case selection.

1. A Class 1/1 malocclusion with an overjet up to about 11 mm, and a deep overbite

The Andresen appliance is essentially a method of reducing the overjet and overbite in Class 1/1 malocclusions, and this allows normal lip function and development to resume in the growing individual (Fig. 3.2).

However, there are obviously limits to how much overjet reduction can be achieved by this method. If the overjet is more than 11 mm it may not be possible to bring the upper incisors into lip control, unless an unusual amount of mandibular forward growth occurs, or the upper incisors are allowed to become unacceptably retroclined.

If the upper incisors are not retracted sufficiently to bring them fully under lip control (Fig. 3.3), then the lower lip can resume incorrect activity and relapse will occur as the overjet increases again. Also, if overjet correction is achieved

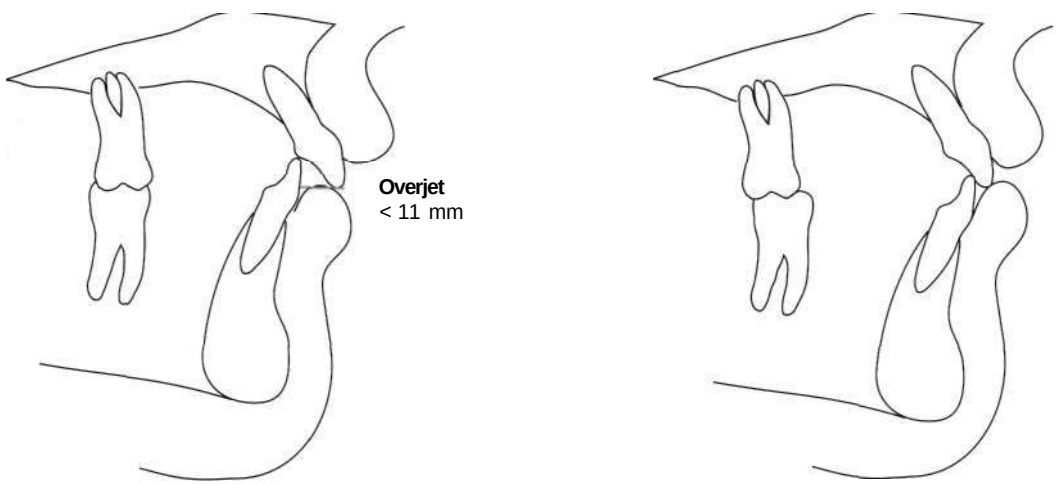


Fig. 3.2 The Andresen appliance is essentially a method of reducing the overjet and overbite in uncrowded Class 1/1 malocclusions.

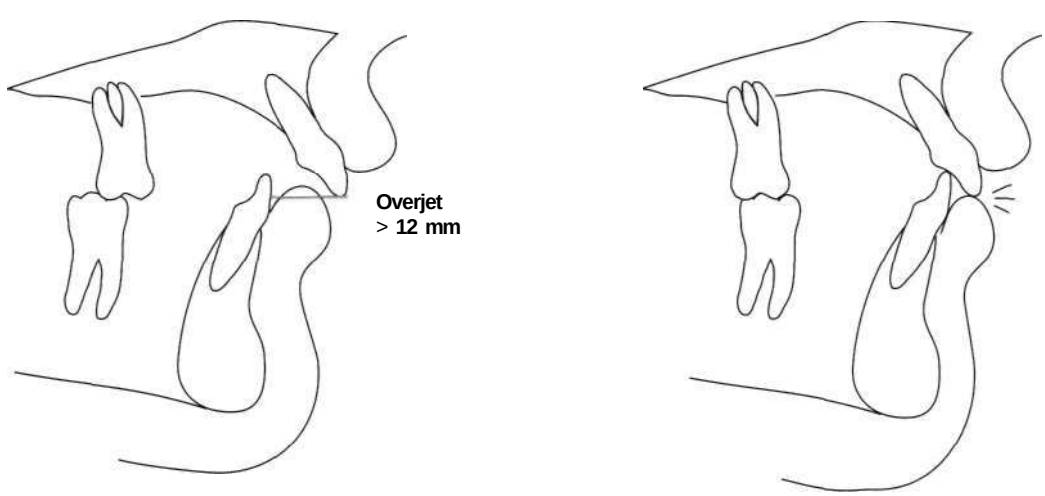


Fig. 3.3 If the overjet is more than 12 mm it may not be possible to bring the upper incisors fully into lip control.

Orthodontically for cases with an overjet larger than 11 mm, there may be a risk that long-term stability will not be good, due to the inability of the condyles to support the new position of the mandible. This is mainly an issue in girls (**Chapter 9).**

clinical experience suggests that low-angle deep bite cases respond well to Andresen treatment, producing notably favorable facial change, especially in boys (Cases OD and DI),and this may be due to lower molar eruption when wearing the appliance. Possibly for the same reason, above average or higher angle cases with an incomplete overbite, or anterior open bite, often do not treat out well using a conventional Andresen appliance. Vertical skeletal issues are discussed in more detail on page 32 of this chapter.

2. A horizontal skeletal pattern that is Class I or mild Class II

If the cephalometric radiograph indicates that the case has a moderate to severe horizontal skeletal discrepancy, careful assessment is needed, as the case will probably not be suitable for the Andresen appliance. The Class II pattern may be assessed by the following methods:

- Measurement of ANB angle
- The Wits appraisal
- Incisor torque correction
- Mandibular protrusion.

Assessment using ANB

The angle ANB ('A' point - nasion - 'B' point) was introduced by Reidel in 1952[3] and it remains a convenient and widely used method to measure A/P skeletal discrepancy, with a figure of + 2 degrees being regarded as average normal Class I. The well-known shortcomings of ANB[4] relate to the difficulty of measuring 'A' point accurately and geometrical unreliability due to variation in the A/P position of nasion. Cases with ANB + 6 degrees or greater should be analyzed in more detail, to determine if they are suitable for treatment with an Andresen appliance (Fig. 3.4).

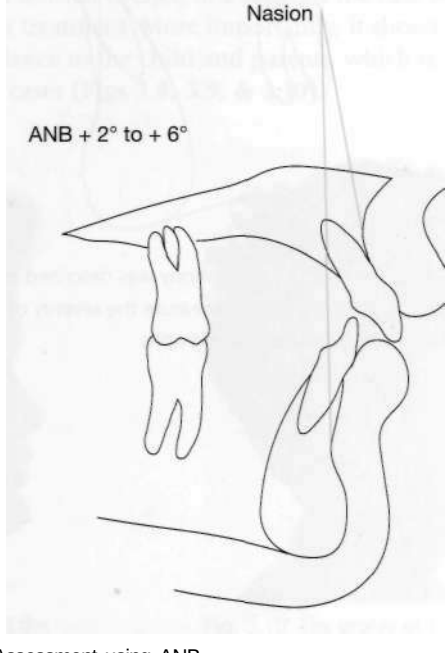


Fig. 3.4 Assessment using ANB.

Assessment using the Wits appraisal

This has been proposed as a more reliable method of assessing horizontal skeletal pattern, and was first described by Jacobson in 1975[45] as: 'Not an analysis *per se*, but a diagnostic aid to measure the severity of A/P jaw disharmony on a lateral cephalometric radiograph.'

It is easy to use and is based on perpendicular measurements from 'A' point and 'B' point to the occlusal plane, drawn through maximum intercuspation (Fig. 3.5), and defined as a line joining the midpoint between the incisal edges (anterior) and the midpoint between the first molar mesial cusp tips (posterior). Class II cases show a positive Wits measurement, with + 2 mm being described as 'mild,' + 4.5 mm as 'definite Class II,' and + 9 mm 'severe,' compared with a Class I normal of - 1 mm in males and zero in females.

In a personal communication to Jacobson,[4] McNamara and Ellis recorded mean Wits measurements of -0.7 mm in males and + 0.9 mm in females. These figures were from the Foundation for Orthodontic Research study, and based on 41 males and 81 females over the age of 16 years possessing 'ideal facial aesthetics and untreated Class I relationships.'

There is evidence[6] that a previous Class II growth pattern continues in untreated males between age 9 and 15 when assessed using the Wits analysis (Fig. 3.6), but this is less evident in females, or when cases are analyzed using ANB.

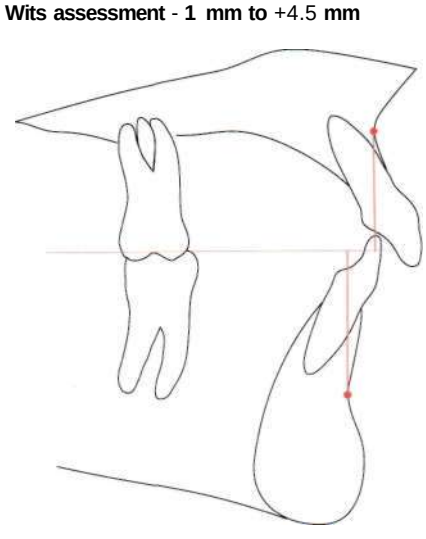


Fig. 3.5 The Wits appraisal of jaw disharmony was described by Jacobson in 1975 as a diagnostic aid to measure the severity of A/P jaw disharmony on lateral cephalometric radiographs.

Fig. 3.6 There is evidence that a previous Class II growth pattern continues in untreated males between ages 9 and 15 when assessed using the Wits analysis.

Assessment using incisor torque correction

This quick and useful assessment **(Fig.** 3.7) of the underlying Class II skeletal discrepancy is based on ideal upper incisor position as follows:

1. Correct the position of the upper incisors to ideal torque.
2. Correct the position of the lower incisors to ideal torque.
3. Measure the resulting overjet. Careful clinical judgment is then needed. If an excessive overjet is revealed it may be necessary to consider orthognathic surgery.

The Andresen/fixed treatment method is not suitable for cases with a severe Class II skeletal relationship because they cannot be fully treated in this way without an unusual amount of growth (which cannot be relied upon) or an unacceptable amount of dental compensation (upper incisor retroclination). The severe skeletal pattern can be explained to the parents, indicating that an ideal outcome will probably not be possible without later surgery to one or both jaws.

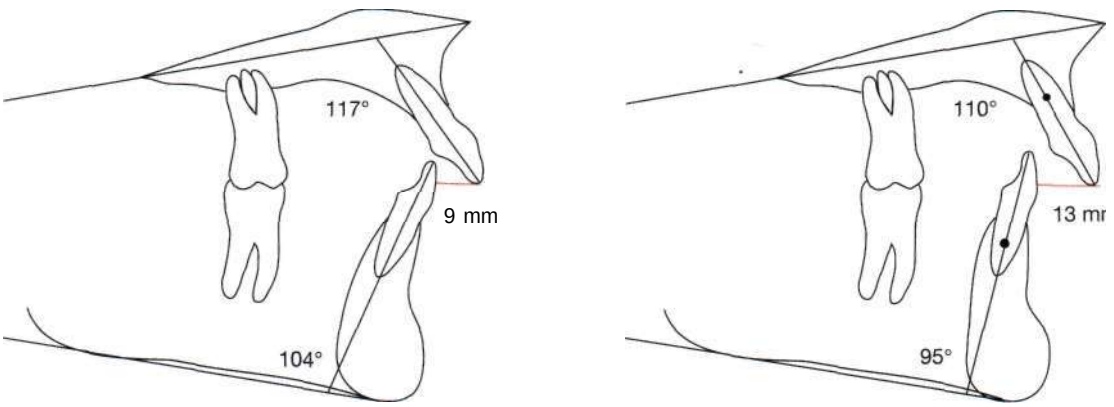


Fig. 3.7 Assessment using incisor torque correction. When upper and lower incisors are adjusted to ideal torque positions the overjet increases to 13 mm from 9 mm.

Assessment by mandibular protrusion

Before treatment it is helpful to ask the child to protrude the mandible, to give a simulation of how the facial appearance would be if mandibular growth occurred. If it is possible to protrude the mandible in a modest, comfortable way, to achieve a normal overjet, this suggests the case is suitable for Andresen treatment. More importantly, it shows improved facial balance to the child and parents, which is motivational in many cases **(Figs 3.8,** 3.9, & **3.10).**

Fig. 3.8 The profile of Case 0D (page 74) before treatment.

Fig. 3.9 The profile of Case OD with the mandible protruded, before treatment.

Fig. 3.10 The profile of Case OD after 18 months of treatment.

-assessment using incisor torque correction

This quick and useful assessment (Fig. 3.7) of the underlying Class II skeletal discrepancy is based on ideal upper incisor position as follows:

1. Correct the position of the upper incisors to ideal torque.
2. Correct the position of the lower incisors to ideal torque.
3. Measure the resulting overjet. Careful clinical judgment is then needed. If an excessive overjet is revealed it may be necessary to consider orthognathic surgery.

The Andresen/fixed treatment method is not suitable for cases with a severe Class II skeletal relationship because they cannot be fully treated in this way without an unusual amount of growth (which cannot be relied upon) or an unacceptable amount of dental compensation (upper incisor retroclination). The severe skeletal pattern can be explained to the parents, indicating that an ideal outcome will probably not be possible without later surgery to one or both jaws.

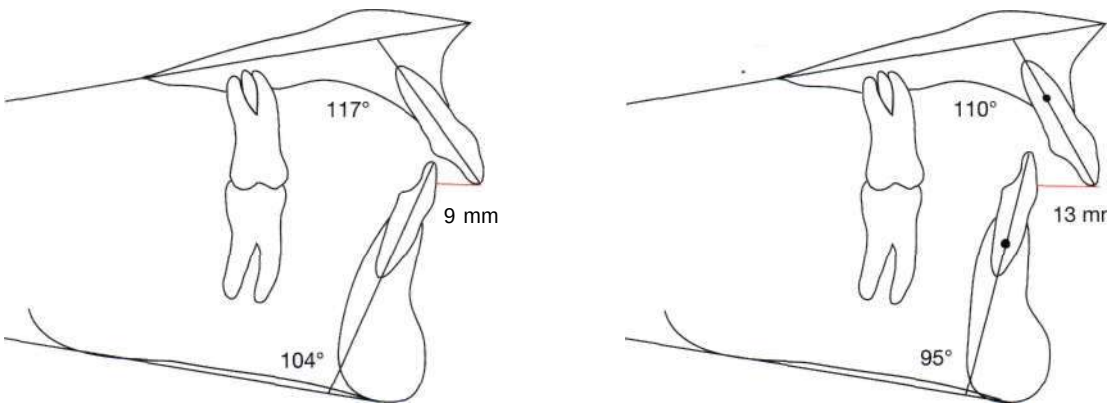


Fig. 3.7 Assessment using incisor torque correction. When upper and lower incisors are adjusted to ideal torque positions the overjet increases to 13 mm from 9 mm.

Assessment by mandibular protrusion

Before treatment it is helpful to ask the child to protrude the mandible, to give a simulation of how the facial appearance would be if mandibular growth occurred. If it is possible to protrude the mandible in a modest, comfortable way, to achieve a normal overjet, this suggests the case is suitable for Andresen treatment. More importantly, it shows improved facial balance to the child and parents, which is motivational in many cases (Figs 3.8, 3.9, & 3.10).

Fig. 3.8 The profile of Case OD (page 74) before treatment.

Fig. 3.9 The profile of Case OD with the mandible protruded, before treatment.

Fig. 3.10 The profile of Case OD after 18 months of treatment.

3. A vertical skeletal pattern that is normal or hypodivergent

Cases to be treated by the functional/fixed method are likely to respond well to the Andresen appliance if the MM angle (the maxillary/mandibular planes angle) is 28 degrees or less (Fig. 3.11).

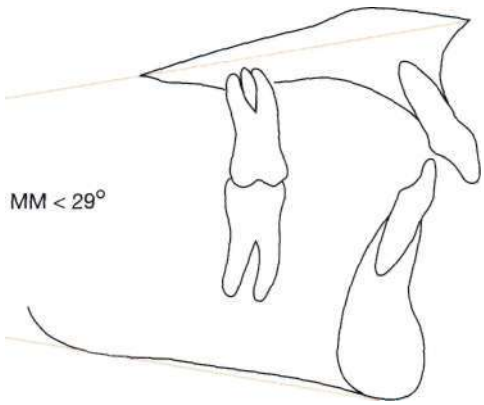


Fig. 3.11 The vertical pattern may be assessed using the MM angle, and cases to be treated by the Andresen appliance are likely to respond well if the MM angle is 28 degrees or less.

More acrylic trimming of the Andresen is appropriate in the low-angle over-closed type of case, to allow eruption of posterior teeth. For many of the average-angle cases, most of the acrylic can be left untrimmed, to restrict eruption of the lower molars (Figs 3.12 & 3.13). Posen[7] used the Andresen in preference to other treatment methods for selected cases for 15 years, and he noted that the appliance: 'Can be trimmed to allow eruption of posterior teeth or can be adjusted to prevent eruption of posterior teeth.'

A long-term follow-up of Andresen cases by Pancherz[8] included 'mild' high-angle cases. These showed a greater tendency to overjet relapse and were generally less successful than the average or low-angle cases. This was attributed to unfavorable mandibular growth combined with atypical tongue function in some cases.

The panoramic radiograph can be used for assessment of condyle anatomy before treatment.[9] Ideally, condyles will be large and well formed, with a clearly defined anatomy, which can be expected to support favorable mandibular growth during the functional appliance phase.

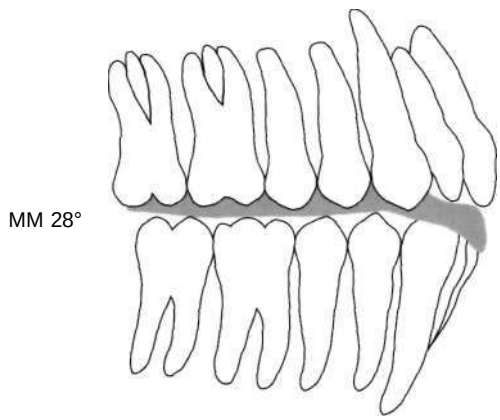


Fig. 3.12 For many of the average-angle cases, the acrylic can be left untrimmed, or minimally trimmed, to restrict eruption of the lower molars.

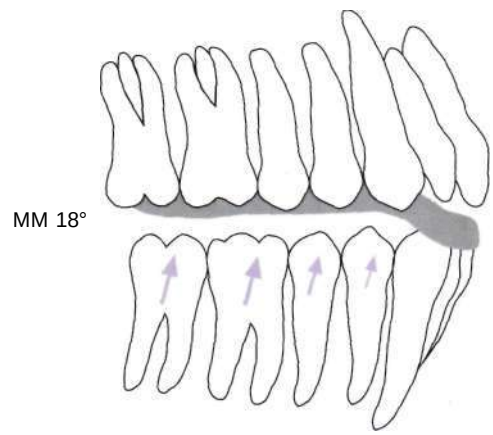


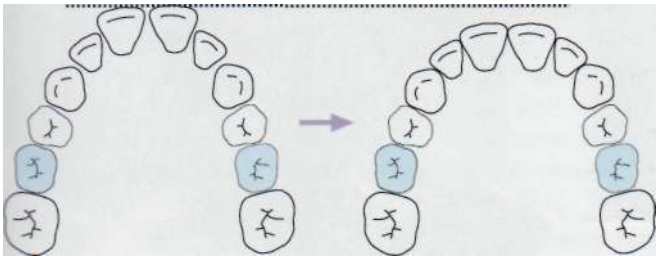
Fig. 3.13 Acrylic trmming of the Andresen is appropriate in the low-angle over-closed type of case, to allow eruption of posterior teeth.

4. Generally well-aligned dental arches, with little or no crowding

The upper anterior teeth

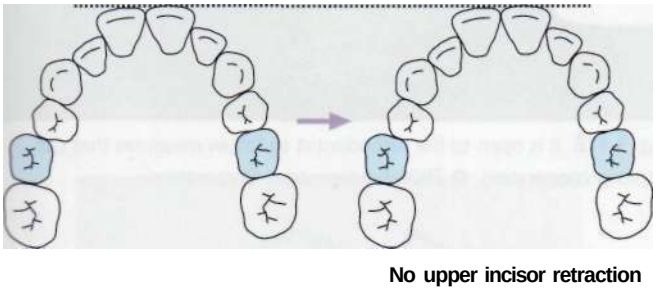
Upper incisors retrocime during overjet correction with the Andresen appliance, closing any small spaces (Fig. 3.14).

Good upper incisor alignment is normally maintained as the overjet reduces during Andresen wear, although minor irregularities may appear, but if the upper incisors are crowded at the start of treatment, the irregularity may increase to an unacceptable extent. Alternatively, crowded upper incisors may not be free to retrocline, and this can prevent overjet correction with a functional appliance (Fig. 3.15).



The upper incisors are retracted

Fig. 3.14 Upper incisors retrocline during overjet correction with the Andresen appliance, closing any small spaces.

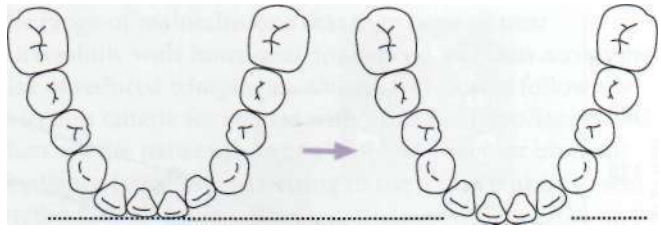


No upper incisor retraction

Fig. 3.15 If the upper incisors are crowded at the start of treatment they may not be free to retrocline, or the irregularity may increase to an unacceptable extent.

The lower anterior teeth

Ideally, there should be a well-aligned lower labial segment. However, some proclination of lower incisors occurs during overjet correction with functional appliances, including the Andresen appliance, and this assists in resolving any minor crowding that may have been present at the start of treatment (Fig. 3.16). However, cases with obvious lower anterior crowding should be treated by another method, because the Andresen appliance allows and encourages upward and forward eruption of the lower molars (page 61). This will increase lower crowding to an unacceptable extent in most cases.



Proclination of incisors

Fig. 3.16 Some proclination of lower incisors occurs during overjet correction with functional appliances.

5. A growing patient with a cooperative attitude

A growing patient

The timing of treatment is discussed in Chapter 2, with the recommendation that ideally the Andresen appliance should be fitted when the patient reaches the late mixed dentition or the early permanent dentition (page 15). Most individuals are growing at this stage of dental development (Fig. 3.17A). There is a lot of individual variation, but at age 14 or 15 years there may be little growth to come. Also, the incorrect lip activity will have become established, and be more difficult to correct.

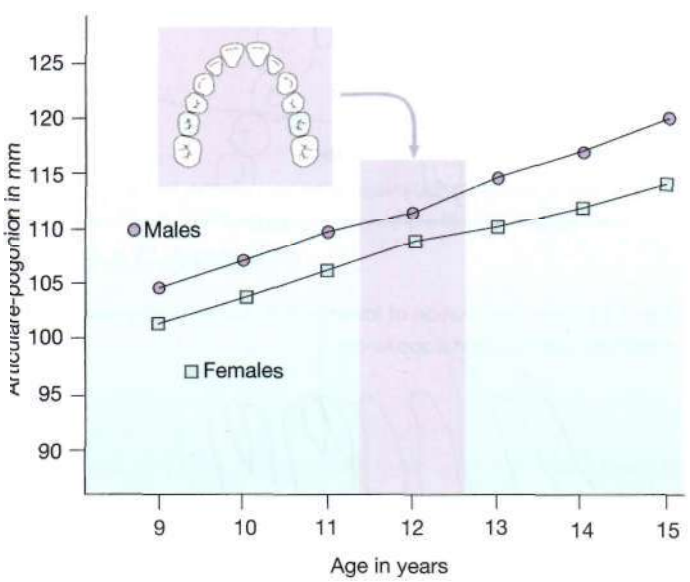


Fig. 3.17A If the Andresen appliance is fitted in the late mixed dentition there is normally plenty of growth available.

A cooperative attitude

Chapter 4 reviews the role of the orthodontist in achieving good patient cooperation. It is not possible to reliably predict compliance, but it is open to the orthodontist to follow measures that have been shown to bring improvements in this vital area (Fig. 3.17B). It is clear that if the youngster does not wear the appliance the treatment will not progress, and so case selection should favor individuals with a positive attitude.

Fig. **3.17B** It is open to the orthodontist to follow measures that can improve cooperation. © 2006 Jupiterimages Corporation.

APPLIANCE MODIFICATIONS TO WIDEN THE CASE SELECTION?

There have been many suggested modifications to the elegant simplicity of the Andresen appliance over the years. These have included such features as Adams clasps, torqueing spurs, buccal shields and high-pull headgear, and the design modification often carries the name of the orthodontist who suggested it. But if functional appliances become more complicated this generally makes them more difficult to wear and liable to breakage, and thus impacts unfavorably on compliance.

One of the aims of increased complexity is to extend the range of cases treatable with functional appliances, beyond that which is known to be ideal for an Andresen. There is then a tendency for all functional appliance patients to be given complex appliances, regardless of the features of the malocclusion. A normal Andresen would work well for many of these individuals, particularly the low-angle cases, without the patient being asked cope with the added complexity of a headgear, torqueing springs or other modifications.

There is little evidence to suggest that the modified designs are more successful than the original Andresen. The added features may have theoretical advantages, but the device is more complex for the child who has to wear the appliance (Fig. 3.17C). So it becomes more difficult to wear, and this inevitably leads to reduced cooperation.

Fig. 3.17C Modifications to the original Andresen design can be more difficult to wear and carry a greater risk of distortion.

Headgear is unpopular with children (Fig. 3.17D), and must be considered as a barrier to compliance. In an interview study[10] of patients who were asked to wear a headgear activator it was found that: 'The children felt themselves to be different from other children because they had to wear the HG activator, and were therefore embarrassed. They did not want anyone who was not aware of their treatment to see them with their HG activator. Exceptions to this were their closest friends, whom they trusted not to tell anyone else about the treatment.'

Some orthodontists will continue to favor the more complex designs, including HG activators, with the aim of extending the range of malocclusions that they hope to treat successfully with functional appliances, and thus accept the risk of reduced compliance. Others will closely follow the selection criteria for success with functional appliances and then ask the patient to wear a basic Andresen or bionator appliance (page 57), preferring to use a different treatment method for all other cases.

Fig. 3.17D Headgear is unpopular with children and can be a barrier to compliance. Since 1992 the author has not included headgear wear in treatment planning. This archive image of a cervical pull HG was taken before the introduction of safety release mechanisms, which were introduced to reduce the risk of facial injury.

THE CORRECTION OF CROSSBITES

Early use of a quadhelix

Ideally any posterior dental crossbites should be corrected in the mixed dentition using a quadhelix (Fig. 3.18) or similar appliance, to eliminate displacements and to prevent the crossbite being carried through into the adult dentition. This should be completed as a simple interceptive measure, well before the Andresen.

Rapid maxillary expansion (RME)

Upper arch expansion with a quadhelix appliance will normally correct a posterior crossbite of dental origin. If a crossbite is bilateral and/or of skeletal origin, RME may be required (Fig. 3.19), but this indicates that the case will probably not be ideal for the functional/fixed treatment method. A skeletally narrow maxilla, often associated with a high-angle skeletal pattern, is normally a contraindication to functional appliance treatment.

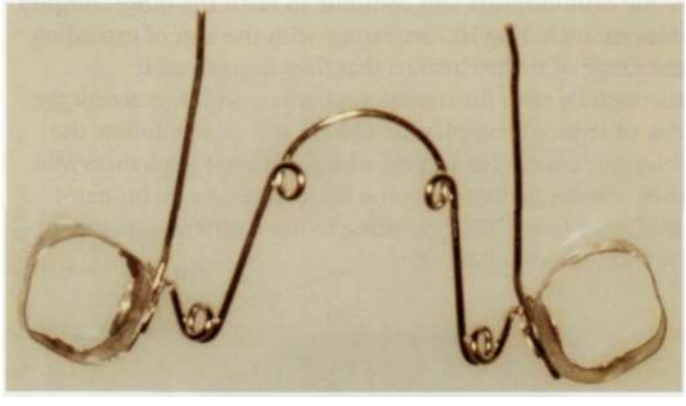


Fig. 3.18 Ideally, any posterior dental crossbites should be corrected in the mixed dentition using a quadhelix as a simple interceptive measure, well before the Andresen appliance.

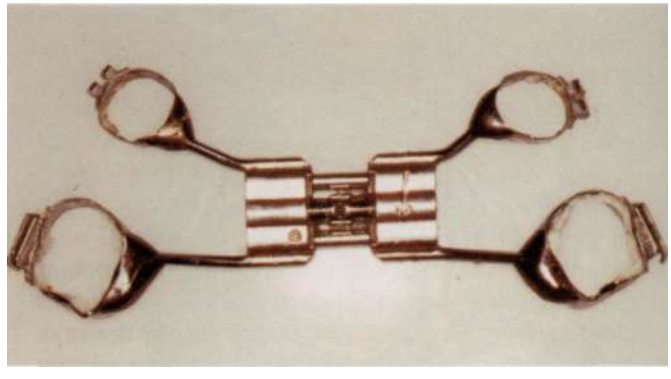


Fig. 3.19 If a crossbite is bilateral and/or of skeletal origin, and requires RME for correction, this normally indicates that the case will not be ideal for the functional/fixed treatment method.

An expansion device built into the Andresen appliance

Many routine cases, starting in the late mixed dentition, will require upper dental expansion to maintain good arch coordination as the overjet reduces. It is possible to use the Andresen appliance to achieve this upper-arch expansion by including a Coffin spring or expansion screw in the construction. However, this increases the complexity of the appliance, and it is normally preferable to use a quadhelix for crossbite correction before the main treatment, which allows a simpler design of Andresen to be used.

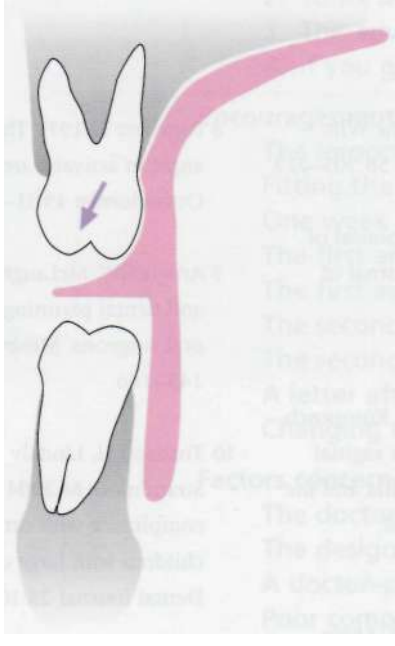


Fig. 3.20 It is possible to grind grooves into the acrylic adjacent to upper molars and premolars, so that they are guided in a distal and buccal direction during eruption, and this can help to maintain good lateral arch coordination as the overjet reduces.

Expansion using acrylic grooves in the Andresen appliance

It is an accepted technique to grind grooves into the acrylic adjacent to upper molars and premolars, so they are guided in a distal and buccal direction during eruption (Fig. 3.20). This can assist in upper-arch expansion, and help to maintain good arch coordination as the overjet reduces.

Correction using the fixed appliances

The upper rectangular arch wire can be expanded to correct minor crossbites (Case OD, page 76), and it is helpful to add buccal root torque for bodily movement. Cross elastics can be used where necessary, but skeletal narrowness can be a limiting factor in some cases (Fig. 3.21).

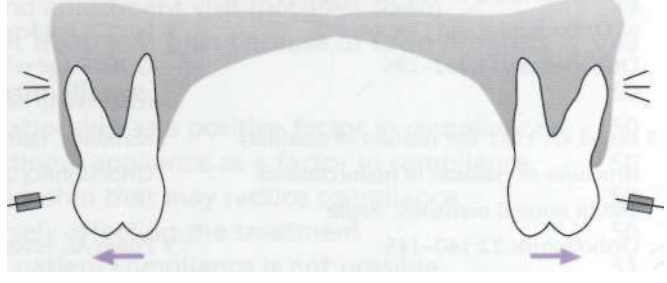


Fig. 3.21 The upper rectangular arch wire can be expanded during the fixed-appliance stage, to correct minor crossbites, adding buccal root torque for bodily movement.

SOFT TISSUE ANOMALIES AND DIGIT SUCKING

Soft tissue anomalies need to be identified, because they can adversely affect any orthodontic treatment, and may be a contraindication to functional/fixed treatment. They can also undermine stability, and Pancherz[8] noted atypical tongue function as a main reason for relapse in long-term follow-ups. It is therefore necessary to recognize individuals with abnormal swallowing patterns or with an over-active, 'strap-like' lower lip, and explain the difficulty to the child and parents, because treatment success normally depends on permanently changing the soft-tissue behavior, which is difficult in such cases.

Thumb or finger sucking is evident in many moderate Class 11/1 cases, and these individuals can normally be well treated by the functional/fixed method of treatment, provided other criteria are met. Where possible, it is helpful if simple interceptive treatment can be provided to help with abandoning the habit, before starting treatment with the Andresen, and most orthodontists will have preferred methods for helping youngsters to cease digit sucking.

REFERENCES

1 Bishara SE, Ziaja RR 1989 Functional appliances: a review. American Journal of Orthodontics and Dentofacial Orthopedics 95:250-258

2 Barton S, Cook PA 1997 Predicting functional appliance outcome in Class II malocclusions: a review. American Journal of Orthodontics and Dentofacial Orthopedics 112:282-286

3 Reidel RA 1952 The relation of maxillary structures to cranium in malocclusions and in normal occlusion. Angle Orthodontist 22:140-145

4 Jacobson A 1988 Update on the Wits appraisal. Angle Orthodontist 58:205-219

5 lacobson A 1975 The Wits appraisal of jaw disharmony. American Journal of Orthodontics and Dentofacial Orthopedics 67:138-155

6 Lux CJ, Burden D, Conradt C, Komposch G 2005 Age-related changes in sagittal relationship between the maxilla and the mandible. European Journal of Orthodontics 27:568-578

7 Posen AL 1968 The monobloc. Angle Orthodontist 38(2):121-128

8 Pancherz H 1979 The mandibular plane angle in activator treatment. Angle Orthodontist 49:11-20

9 Arnett GW, McLaughlin RP 2004 Facial and dental planning for orthodontists and oral surgeons. Mosby, Edinburgh, 143-146

10 Trulsson U, Lindiilv L, Mohlin B, Strandmark M 2004 Age dependence of compliance with orthodontic treatment in children with large overjet. Swedish Dental Journal 28:101-109

CHAPTER 4

Patient compliance and motivation

QUESTION

V < U E STION

Why is compliance so important and how is it achieved?

A

Y V N S WE R

Compliance with wearing the Andresen is essential to get early overjet reduction, and it is achieved in three ways: (1) by carefully explaining the treatment details to the child and parents to motivate them; (2) by ensuring the Andresen is comfortable; and (3) by scheduling at least 15 minutes for each visit, and not squeezing in appointments because it is a removable appliance.

DEFINITIONS

com • pli • ance noun

1. - the readiness to conform or agree to do something

co • op • er • a • tion or **co-op • er • a • don** noun

1. - the act of working together to achieve a common aim
2. - doing what is asked or required

mo • ti • va **• tion** noun

1. - the act of giving somebody a reason or incentive to do something
2. - a feeling of interest or enthusiasm that makes somebody want to do something.

Encarta® World English Dictionary Publishing Pic

Developed for Microsoft by Bloomsbury Publishing Pic

A basic level of cooperation is required for any orthodontic treatment, even for a simple Class I fixed-appliance case, and successful functional/fixed treatment of uncrowded Class 11/1 cases is totally dependent on compliance. Patients have to carry responsibility for compliance and hence the quality of the result, and they and their parents should be aware of this from the outset.

Patient compliance is a therefore a challenge. It is open to the orthodontist to motivate patients, giving them every reason to cooperate, because there is evidence that the relationship between the patient and the orthodontist is all-important.

The process of patient motivation can start at the case presentation visit, and continue with encouragement throughout the treatment. Some of the material on the following pages is written informally, with phraseology appropriate for a 12 year old. The examples of dialogue are intended to show that compliance features as a major theme throughout the case presentation and beyond.

Youngsters have a choice in this, along with many other options they face when growing up. For example, they may choose to take piano lessons or football coaching. Likewise, they may choose to cooperate with orthodontic treatment and enjoy the benefits of an ideal occlusion with facial harmony, a pleasing smile and good function. As orthodontists we need to be realistic about the patient's lifestyle, with obligations to parents, teachers, sports coaches and others. We are just one more group of adults asking kids to do things and sometimes they choose to give less than perfect compliance.

THE CASE PRESENTATION

The four main topics during the case presentation may be informally summarized as follows:

1. 'This is your problem ... '
2. 'To fix the problem we need to do the following ... '
3. 'The advantages of fixing the problem are ... '
4. 'If you go ahead, we will need compliance with

Fig. 4.1 Successful functional/fixed treatment of uncrowded Class 1/1 cases is totally dependent on compliance. Patients have to carry responsibility for compliance and hence the quality of the result. It is helpful to use language that will be easily understood by a 12 year old, avoiding too much technical jargon at the case presentation.

1. This is your problem

Tour upper teeth are forwards from the lowers by 11 mm and the normal measurement should be 2-4 mm.' [Showing the patient's models or photos (Fig. 4.2) and comparing them with models or photos of an ideal dentition (Fig. 4.3).]

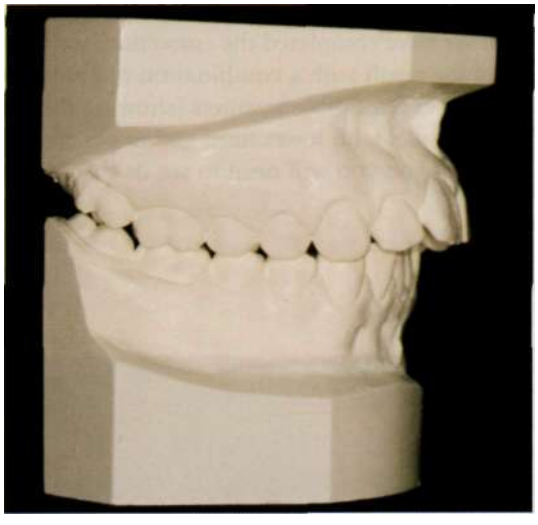


Fig. 4.2

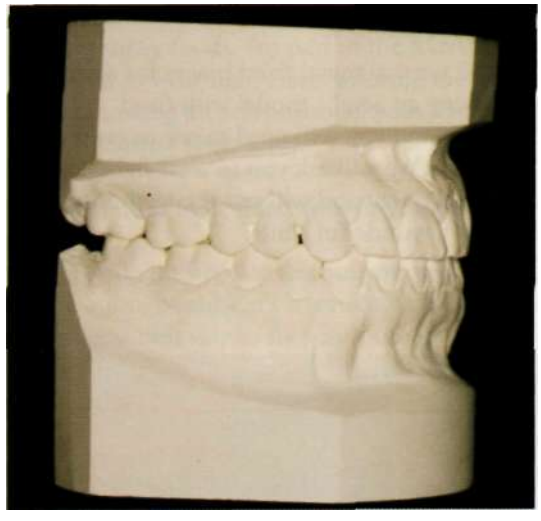


Fig. 4.3

Additionally, the lower lip acts behind the upper incisors, and it should be in front of them.' [Showing the patient's cephalometric radiograph (Fig. 4.4) and comparing it with a normal radiograph (Fig. 4.5).]

Fig. 4.4

Fig. 4.5

2. To fix the problem we need to do the following

'We need to make you a removable appliance, to be worn during the evenings and at night.' [Showing the patient an Andresen appliance (Fig. 4.6).] 'This normally takes 6 to 9 months of good wear and will correct the incisors. We need to start this soon, while you are young and growing, and you will need to see us every 6 weeks.'

'We then need to use normal metal fixed braces for about 12 to 15 months [showing an acrylic model with fixed appliances (Fig. 4.7)], and you will need to see us every 4 weeks during this stage. We will ask you to wear light elastics. This will finish the treatment and will put the teeth into ideal positions, giving you a wonderful smile.'

'We should have the problem corrected within 24 months, and it could be less. You should easily be finished by your 14th birthday/the time you change schools/your planned world trip, etc' [This relates conclusion of the active treatment to an event in the patient's life.]

'After we have completed the correction, we will need to retain the result with a combination of lower fixed and night-time upper removable retainers [showing the patient an acrylic model with lower fixed and upper removable retainers] and you will need to see us every 6 months.'

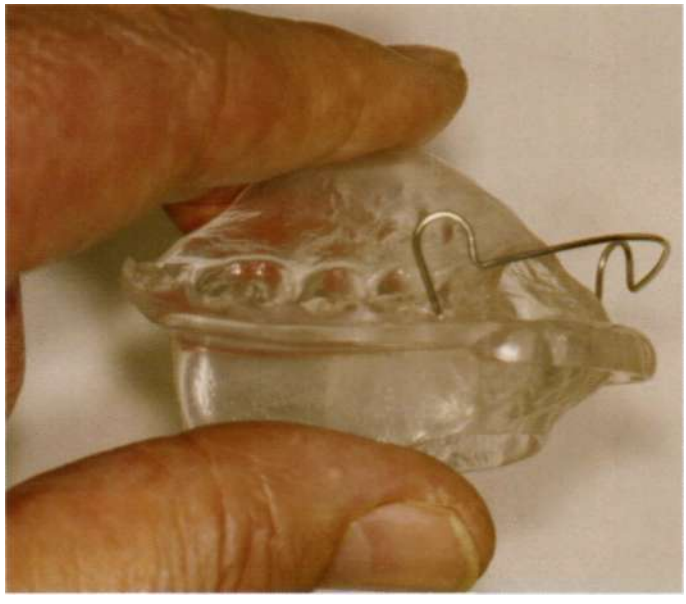


Fig. 4.6

Fig. 4.7

Figs 4.6 and 4.7 The patient can be shown an Andresen appliance and an acrylic model with fixed appliances.

3. The advantages of fixing the problem

'If we retract your incisors to a normal position it will improve facial harmony [showing the patient and parent the profile with the mandible protruded (Figs 4.8 & 4.9)]. This should bring you greater confidence in social contact throughout life. Also, research has shown that there is less risk of damaging your incisors if they are in a correct position.'

4. If you go ahead, we will need compliance

'You will need to wear the removable appliance during the evening and every night for 6 to 9 months'

"We will then ask you to attend for an hour on a quiet morning for fitting of the fixed appliances. You will need to take good care of them, keep them clean, and avoid eating hard or sticky foods. For part of the fixed appliance stage you will need to wear light elastics during the evenings and at night [showing an acrylic model with fixed appliances and Class II elastics (Fig. 4.7)].'

'You will need to be good with appointments.'

'We provide the appliances, but you will need to show good cooperation, because it's a team effort. In my view, this is the easiest and best way to fix your problem.'

FIg. 4.8

Fig. 4.9

FIG 4.8 **and** 4.9 The patient and parent can be shown the difference in profile with the mandible protruded.

ENCOURAGEMENT AND MOTIVATION DURING EARLY TREATMENT

The importance of appointment scheduling for good compliance

It is a common error to consider the fitting or adjusting of functional appliances as trivial procedures, to be squeezed into appointment scheduling. Appointments should have a certain gravitas, with plenty of time available, and there is a need for each visit to be seen as unhurried, caring and considerate.

At each appointment during the early stages of treatment the orthodontist has to convey commitment and build the patient-doctor relationship. This needs time and a considerate, caring manner, and it can't be rushed. The use of well-tried phrases can be helpful. 'I believe in this method. I am taking time and effort to make it work, and I want you to do the same. This is the easiest and best way to solve your problem.'

If appointments are failed or rescheduled at short notice, each instance should be recorded in the patient's notes. This information is useful in later discussions, because progress may be adversely affected.

In their 1988 paper Gross and coworkers[1] commented that failure to meet scheduled treatment visits is an important aspect of non-compliance, which may result in less effective treatment or extended treatment times. They suggested a lottery system to re-enforce attendance, and reported that this reduced no-shows by 75%.

Fitting the Andresen - a suggested protocol for good compliance

Where possible the appliance should be fitted with only the child and an assistant present (page 106) and it *has* to be comfortable, as explained in Chapters 5 and 7. The bow has to be passive or lie fractionally away from the incisor enamel surface (page 107) and acrylic needs to be eased in the lingual sulcus area (page 106). After careful fitting the parent can be invited into the room. The starting overjet can then be measured to the satisfaction of all present, and recorded in the notes (Fig. 4.10).

'Here is your functional appliance. It is exactly as it should be, and from today onwards the teeth will start to improve. The overjet is 11 mm today. Let's meet in 6 weeks and check the progress. It should be down to 10 mm or even 9 mm by then.'

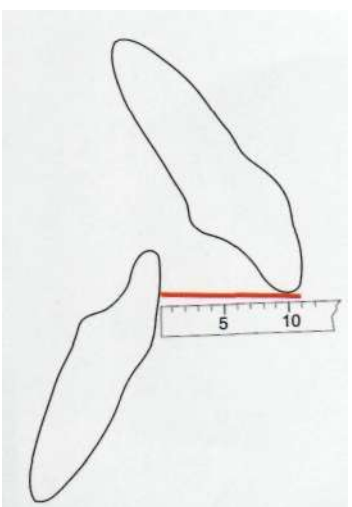


Fig. 4.10 At the time of fitting the Andresen appliance it is helpful to measure the starting overjet to the satisfaction of all present, and to record it in the patient notes. At later visits remeasurement at lower levels is helpful in patient motivation.

One week after fitting the Andresen appliance

A follow-up phone call (Fig. 4.11) from an experienced assistant is helpful, about a week after fitting the appliance.[2] It is a chance to offer advice and encouragement, and to answer any queries.

The first adjustment of the Andresen appliance (going well)

This is an important appointment and a chance to provide motivation for continued compliance. It helps if 15 minutes can be scheduled, preferably at a quiet time, and positive and complimentary comments are needed. Typically, only 5 minutes will be spent doing minor mechanical adjustments, and the remaining 10 minutes can be used to talk with the child and parent, to encourage and re-motivate (page 109).

With only the child and an assistant present, and after normal social pleasantries:

'How many marks, out of ten, do you give yourself for wearing the appliance? Eight is very good. Try to keep it at eight, or get it up to nine. Do you think the teeth have moved? I think you're looking better already. Shall we measure the overjet? It's down to 9 mm - well done!'

To the parent, and in the hearing of the child:

'We are off to a very good start, and I'm sure you've noticed the nice changes already. Well done! Let's meet again in 6 weeks.'

Fig. 4.11 A follow-up phone call from an experienced assistant or from the orthodontist is helpful.

The first adjustment of the Andresen appliance (progress so-so)

Positive and complimentary comments are needed, even if the improvement in the first few weeks is less than expected.

With only the child and an assistant present, and after exchanging normal social pleasantries:

'How many marks, out of ten, do you give yourself for wearing the appliance? Six is good, but try to get it up to eight or nine. Do you think the teeth have moved? Shall we measure the overjet? It was 11 mm and now I think it is a bit less, maybe $10^{1/2}$ or 10. Try to make sure you wear it for a few hours each evening and every night - that way we'll make the best progress. Please, do the best you can.'

To the parent, and in the hearing of the child:

'The appliance is fine and there may be a small improvement already. Please try to make sure the appliance is in the mouth for a few hours each evening and every night, and get into a routine - that way we'll make really fast progress. Let's meet again in 6 weeks.'

The second and subsequent adjustment visits (going well)

It is important to continue to re-enforce motivation and compliance.

With only the child and an assistant present, and after normal social pleasantries:

'How many marks, out of ten, do you give yourself for wearing the appliance? Nine is really good, well done! Shall we measure the overjet? It's down to 7 mm - we're making excellent progress!'

Later, to the parent, and in the hearing of the child:

'We are going along very well, and the overjet is down to 7 mm. I am very pleased with the way the treatment is going. We have achieved a 30% change in only two visits, which is excellent progress. Let's meet again in 6 weeks.'

The second adjustment visit (progress continues so-so)

Normally patients wear the appliance well, so that the overjet will have reduced by at least 3 or 4 mm by the time of the second adjustment. This assumes the case selection was correct, the appliance was well made, and the timing of the treatment was correct.

However, in a few cases progress may be so-so, with little measurable change in overjet. Positive and friendly comments are still needed, but it is necessary to address the issue of non-compliance at this early stage, and mention other treatment methods.

With only the child and an assistant present, and after exchanging normal social pleasantries:

'How are you getting on with the appliance? How many marks, out of ten, do you give yourself for wearing the appliance? Six may not be enough to really move the teeth. Do you think they have moved? Shall we measure the overjet? It was 11 mm and now I think it is a bit less, maybe $10^{1/2}$ or 10.'

The parent can be invited into the room:

'The appliance is fine and we have carefully adjusted it today. It is exactly as it should be. Please try to ensure plenty of hours of wear. The appliance should be in the mouth for a few hours each evening and every night. Progress is slower than we hoped, and we may need to consider an alternative treatment. Let's meet again in 6 weeks, and we can measure the overjet then.'

A letter after the second adjustment visit (progress so-so)

If treatment response, and therefore compliance, is judged to be poor at the second adjustment visit, things are unlikely to improve dramatically, and a standard follow-up letter is helpful. This prepares the ground for an early switch to another treatment approach.

Dear

I was pleased to see Jenny for routine appliance adjustments yesterday.

As we discussed at the outset, we need to reduce the overjet as the first stage of the orthodontic correction. At present the tooth movements are slower than predicted, and I would he grateful if you would give jenny every encouragement to wear the removable appliance as requested.

It should he in the mouth for a few hours each evening and every night. Normally this gives us a pleasing and rapid improvement, and so we are hoping that the overjet will have reduced to about 8 mm by the next visit.

However, a few individuals do not respond well to this treatment approach, and we may find that progress is less than we hoped for. If so, there are other ways to reach our treatment goals, and we should discuss these after the next visit.

Please do not hesitate to call me if you have any concerns.

Sincerely,

Changing to a different treatment plan because of so-so progress

Most patients show good progress with the Andresen appliance. However, a few individuals are unable to provide enough cooperation, and this will be clear by the third adjustment visit. Assuming the case selection is correct, the appliance is well made, and the timing of the treatment is correct, the overjet will reduce if the appliance is being worn sufficiently. If the overjet is not reducing, and poor compliance is evident during the first 3 months, it is unusual for this to improve.

Other treatment possibilities should be discussed, which may include:

Waiting for 6 months and trying again, if the patient is young enough.

- Supplying a different type of functional appliance, which requires less cooperation, such as a Herbst.
- « Treating the case with only fixed appliances and Class II elastics, possibly with the loss of two upper premolars.

It is easier to offer to switch to another treatment plan during the first 3 months, as soon as poor compliance becomes evident. The switch can be presented in a positive way, to maintain a good relationship with the patient and parents:

A few patients don't respond well to the Andresen appliance, so let's try a different treatment approach.'

In most instances the poor response is due to not wearing the appliance enough, but it is not helpful to discuss this or to attribute blame. It is better to change the treatment plan and move on, than to struggle on with the Andresen for many months with poor compliance and a deteriorating relationship with the family.

FACTORS CONCERNING PATIENT COMPLIANCE

The doctor-patient relationship as a positive factor in compliance

There are actions by the orthodontist that can improve patient compliance. Nanda and coworkers[3] stressed the importance of the relationship between the orthodontist and the patient: 'One outstanding feature of this investigation was that the doctor-patient relationship had a positive impact on the cooperative behavior of the patients.' They went on to observe that: 'We as doctors may tend to blame the patients rather than ourselves, if the course of treatment is not going as desired. If we were to look at ways to improve communication with our patients, we might be able to salvage a potentially uncooperative patient.'

Barbour and Callender[4] gave questionnaires to hundreds of patients who were clearly identifiable as extremely compliant or non-compliant in orthodontic offices in the USA. The only items that produced opposite responses between the two groups were:

'My orthodontist praises me when I do well.'

'My orthodontist cares about my feelings.'

'My orthodontist is fair in judging my progress.'

They commented that these statements are not about the patient or even about the orthodontist. They are about the relationship between the patient and the orthodontist.

The design of the functional appliance as a factor in compliance

Where possible, orthodontists should make the orthodontic road an easy one, because a patient will find it easier to cooperate with an uncomplicated regime and a simple functional appliance. Also, for most individuals, a 10-hour wearing regime will be preferable to a 24-hour requirement.

As discussed in Chapter 5, the basic Andresen appliance is a simple design and needs to be worn only 8-10 hours in each 24, which should help compliance. Any increase in complexity of the appliance or the regime can be expected to make compliance more difficult. For example, Bondevik[5] emphasized the need to strive for good cooperation, and noted that it was not recommended to add a headgear, as this was not well accepted by the patients in his study.

A doctor-patient relationship that may reduce compliance

Barbour and Callender[4] listed a number of factors that have been found to interfere with doctor-patient interaction, reducing compliance:

1. The doctor seeking information from the patient without explaining why, as if the information were only important for the doctor.
2. Tension emerging during the doctor-patient interaction, which is not addressed or resolved.
3. Patients feeling that their expectations are not being met, or feeling that the doctor is treating them impersonally.[4,6]

Poor compliance adversely affecting the treatment

It is to be expected that poor compliance will extend the treatment time. In his 1986 review of 500 consecutive orthodontic cases Shia[7] stated that poor cooperation was the 'single most important factor contributing to treatment over-runs.' Poor compliance also undermines treatment success, and the literature contains many findings on this. For example, in a study of 50 patients Ahlgren[8] noted: 'The most obvious reason for unsuccessful treatment was poor cooperation.' Berg[9] reviewed problems and failures in 264 consecutively treated cases and reported inadequate patient cooperation in 32% of the activator cases. Bondevik[5] reported on 78 patients and observed that: 'No individual in the study with decreasing or poor cooperation had a satisfactory result.'

Accurate prediction of patient compliance is not possible

Before treatment the patient may show a generally positive or negative attitude towards orthodontics, but it is not logical for the orthodontist to try to accurately predict levels of compliance for individual patients, because several studies have shown that this is not possible.

In 1985 Gross and coworkers[10] found few reliable predictors for patient compliance, but suggested that compliance may be greater among patients who view their orthodontic condition as severe.

In 1988 Jane Folger[11] tried unsuccessfully to develop a test to identify non-compliant patients, but some of the findings were interesting. A group of 120 children in a Californian practice were divided into high- and low-compliance groups, on the basis of appliance wear, appliance loss or breakage, oral hygiene, and appointment keeping. Compliance was better when the mother had more positive beliefs about the procedure and the clinician, and reported higher levels of household organization. Different designs of removable appliance were used in the study, and it was found that the children were significantly more likely to comply with the Schwarz plate, which was the least cumbersome of the four appliances.

In 1992, Nanda and coworkers[3] published a prospective study of 100 adolescent patients, but concluded that none of the variables selected for their investigation adequately predicted cooperation of an individual patient in orthodontic treatment. The complex nature of individual human behavior (particularly among their teenage group, presumably!) was given as one of the reasons that it was so difficult to predict patient cooperation.

Improving compliance with a behavioral model

In 1985, Gross and coworkers[10] suggested a two-part system of patient rewards for good compliance - a so-called behavioral model:

1. The patients must have a solid understanding about what is required of them, and it needs to be established that this is within the capability of the child. For example: 'Here is your Andresen appliance. You need to wear it during the evenings and every night.'
2. A system, of'reinforcers' can be introduced, to encourage compliance. Parents can list activities that their children will find rewarding, such as special attention from the parents, going to the park, sports, and increased allowance. Gross et al reported that a scheme of this type greatly reduced parent-child conflicts related to dental health. Parents stated that they did not have to nag their children to comply!

Patient logs as poor indicators of actual compliance

In some studies patients have been asked to keep a written record of the hours of cooperation, referred to as a 'log,' but experiences with these have been disappointing. For example, Tulloch et al[12] found that few patients actually kept a log, despite having been asked to do so. Among those that did, the children and parents systematically inflated the number of recorded hours, so the log over stated the level of compliance. They noted that logs were certainly poor indicators of actual cooperation. Clemmer and Hayes[13] reported similar discrepancies when patients were asked to keep a log of compliance with headgear wear. Bondevik[14] asked patients to record the hours of wear each day, but reported that the system failed.

The difficulty in changing human behavior

It is accepted that it is difficult to change human behavior. A 1992 study by Rinchuse and coworkers[15] investigated oral hygiene compliance in orthodontic patients, and possible methods of improving it. The findings were generally inconclusive and emphasized the difficulty in investigating this subject, and in controlling or changing human behavior. For example, they found that when parents checked the tooth brushing this appeared to produce poorer oral hygiene, and felt this may reflect the social interactions common to this patient age group.

They agreed with Martens[16] and concluded that: 'The simple application of behavioral principles is probably not a quick fix for the many compliance problems in dentistry. If it were, we would be more successful in motivating patients to stop smoking, change habits of drug and alcohol abuse, practice better nutrition, and comply with oral hygiene instructions'

REFERENCES

1 Gross AM, Bishop W, Reese D, Lollis T, Janke C, Hedden C et al 1988 Increasing patient compliance with appointment keeping. American Journal of Orthodontics and Dentofacial Orthopedics 3:259-260

2 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh, 113

3 Nanda RS, Kierl MJ 1992 Prediction of cooperation in orthodontic treatment. American Journal of Orthodontics and Dentofacial Orthopedics 7:15-21

4 Barbour A, Callender RS 1981 Understanding patient compliance. Journal of Clinical Orthodontics 12:803-809

5 Bondevik O 1991 How effective is the combined activator-headgear treatment? European Journal of Orthodontics 13:482-485

6 Mathews D, Hingson R 1977 Improving patient compliance: a guide for physicians. Medical Clinics of North America 61(4):879-889

7 Shia Gf 1986 Treatment overruns. Journal of Clinical Orthodontics 9:602-604

8 Ahlgren I 1972 A longitudinal clinical and cephalometric study of 50 malocclusions treated with activator appliances. Transactions of the European Orthodontic Society 285-293

9 Berg R 1979 Post-retention analysis of treatment problems and failures in 264 consecutively treated cases. European Journal of Orthodontics 1:55-68

10 Gross AM, Samson G, Dierkes M 1985 Patient cooperation in treatment with removable appliances: a model of patient non-compliance with treatment implications. American Journal of Orthodontics and Dentofacial Orthopedics 5:392-397

11 Folger J 1988 Relationship of children's compliance to mothers' health beliefs and behavior. Journal of Clinical Orthodontics 7:424-426

12 Tulloch JF, Proffit WR, Phillips C 1997 Influences on the outcome of early treatment for Class II malocclusion. American Journal of Orthodontics and Dentofacial Orthopedics 5:533-542

13 Clemmer EJ, Hayes EW 1979 Patient cooperation in wearing orthodontic headgear. American Journal of Orthodontics 75:517-523

14 Bondevik O 1995 Treatment needs following activator-headgear therapy. Angle Orthodontist 65(6):417-422

15 Rinchuse DJ, Rinchuse DJ, Zullo TG 1992 Oral hygiene compliance: a clinical investigation. Journal of Clinical Orthodontics (26(l):33-38

16 Martens R 1990 Principles of reinforcement, in successful coaching, 2nd ed. Leisure Press, Champaign, IL, 35-36

CHAPTER 5

Functional appliance selection

QUESTION

Which is the preferred type of functional appliance and what are its advantages?

ANSWER

V < U E S T I O N

Which is the preferred type of functional appliance and what are its advantages?

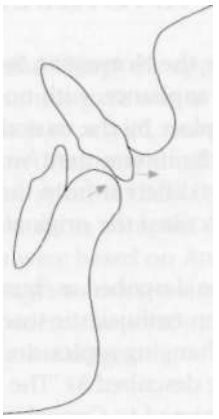
I \ N SWE R

The recommended appliance is the basic activator as described and used by Andresen, without the addition of a headgear or expansion device. This is simple and robust, and easy to wear, so that it is well accepted by the patients and there are few breakages. As designs become more complex, issues of cooperation and breakage occur. Compliance is the main thing.

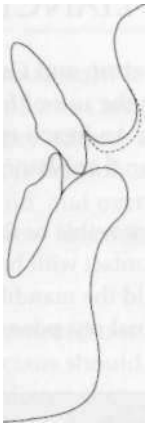
THE FUNCTIONAL PHASE

The main aim of the functional phase is to reduce the overjet and overbite, to achieve a near-normal incisor relationship (Fig. 5.1). Correction of the overjet allows a lip seal to establish, so that normal function and development can resume.

It is necessary to select a functional appliance that will achieve these goals and that is easy for the patient to wear. After careful case selection, and using a suitable functional appliance, tooth movements of this type are easily managed in 6 to 9 months, but are difficult to achieve with fixed appliances (Figs 5.2 & 5.3).



At the start of treatment with the Andresen appliance there is a Class 11/1 incisor relationship with no lip seal, and the lower lip is overdeveloped. It seldom makes contact with the upper lip. The lower lip acts behind the upper incisor at rest, and tends to increase the overjet, due to the mesializing force on the palatal aspect of the upper incisors. Forward movement of the upper incisors is limited only by the need for the roots to be in bone, and is unrestricted by soft tissue.



After successful use of the Andresen appliance, the overjet is near to normal, often with upper incisors retroclined and lowers proclined. The incisors have been brought under lip control. The patient can achieve a lip seal, and the lips can develop normally to provide a restraining influence on the upper incisors. At this stage there may be a slight excess of lower lip volume, which adjusts in time. In contrast, the upper lip is underdeveloped but has the potential to resume normal growth and function.

Fig. 5.1

Fig. 5.2 Case OD at the start of treatment. There was an overjet of 11.5 mm and a deep overbite. Stage-by-stage treatment details are shown at the end of this chapter on page 74.

Fig. 5.3 Case OD after 8 months with an Andresen appliance. Tooth movements of this type are easily managed in 6-9 months with an Andresen, but are difficult to achieve with fixed appliances.

FUNCTIONAL APPLIANCES AND THE WORK OF ANDRESEN

In an excellent review paper Barton and Cook[1] commented that the literature surrounding the use of functional appliances refers mainly to the Andresen type of removable activator. They defined functional appliances as follows:

> 'Functional appliances are removable or fixed orthodontic appliances that are held in contact with both upper and lower dental arches. They hold the mandible in a postured position, away from the normal rest position.'

Fig. 5.4 Dr Viggo Andresen

Dr Viggo Andresen (Fig. 5.4) has been described as the father of functional therapy.[2] He was the son of a goldsmith, and was born in Copenhagen on 31 May 1870. His early studies were in Denmark and Switzerland, but in 1925 he was invited to work in Oslo, where he became Professor of Orthodontics in 1927. It was here that he fully developed his ideas on biomechanics. He worked with a German colleague, Haupl, and together they introduced the 'Norwegian System.'[3]

The Oslo teaching was based on the concept that the function determines how the skeletal development will be, and: 'If you can change the function, you can change the development.' It required courage to come out with such a radical hypothesis in an era dominated by Edward H. Angle. Treatment by the Norwegian System involved the use of a loose fitting appliance, with no retention mechanism, which was held in place by the musculature. It was said to achieve its effect by the intermittent 'work and rest' principle, which was felt to be different from the concepts of Pierre Robin,[4] who had described the original monobloc in 1902.

Andresen was described as 'humorous, tolerant and dynamic,' and he was an enthusiastic teacher,[2] but he was well known for rapidly changing topics, and among his students his lectures were described as 'The Andresen Circus.' In 1936 Andresen returned to Copenhagen, and he died there on the 8 October 1950. During his life he produced more than 100 publications, and the 5th edition of his book was published in Munich in 1953.[5]

The success of the Andresen appliance

Although it was developed more than 70 years ago, the Andresen appliance, which is also known as an activator or monobloc, has been successfully used by generations of orthodontists (Fig. 5.5). For example, writing in 1967 Freunthaller[6] commented that: 'The activator is generally used in Vienna for the treatment of Class 11/1 malocclusion and it has given very good results during the last 25 years in many thousands of cases.' Barton and Cook[1] noted that the literature surrounding the use of functional appliances refers mainly to the Andresen type of appliance.

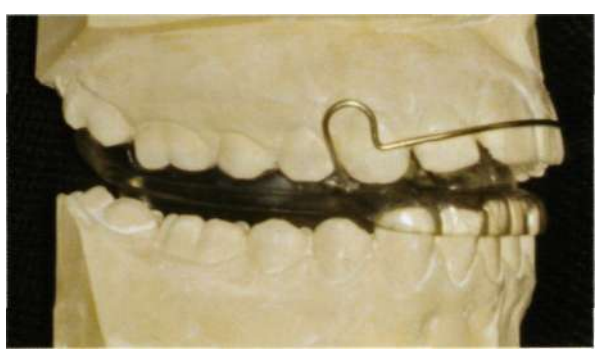


Fig. 5.5 Developed more than 70 years ago, the Andresen appliance has been successfully used by generations of orthodontists. The terms 'monobloc' and 'activator' are also used to describe this type of appliance.

During the time of Andresen and Hiiupl the appliances were made of vulcanized rubber, but this gave way to acrylics in the 1950s. Apart from the switch to acrylic, many clinicians use the original design, or something very similar, and favor it as the appliance of choice for selected Class 11/1 cases. Many do not find a need to use more complex designs (pages 68-71), most of which were based on Andresen's concepts. There can be advantages to using a simple design in terms of laboratory costs, patient cooperation, ease of adjustment, and freedom from breakages.

Graber[7] observed that:

> 'Numerous modifications have been made to the Andresen-Haupl monobloc and have been described in texts and periodical contributions by Petrik, Eschler, Hoffer, Grossman, and others. These are surprisingly effective at times, but generally a simpler design of appliance is preferred.'

The Andresen appliance, in its unmodified form, remains an important treatment option for today's orthodontist, and was used to treat the cases shown in this book. The simple and well-proven design has advantages, and in the right situation it will achieve good overjet reduction if worn only 10-12 hours in each 24. It does not require full-time wear or a headgear. It is robust, so there are few breakages, it is easy and quick to adjust, and the uncomplicated design allows economical laboratory work. Good posterior occlusal contact and function continues during overjet reduction, helping the transition into fixed appliances.

For the clinical orthodontist it may seem sufficient to know that functional appliances are effective, without trying to understand how they achieve their effect. However, to use them efficiently, it is helpful to have some knowledge of the research background, and over the years there has been much discussion about how functional appliances achieve their effect.

Bishara and Ziaja pointed out in their important 1989 review paper[8] that: 'Clinicians should be thoroughly familiar with the functional appliance they use, including its potential benefits and limitations.'

The effect of muscle contraction

Functional appliances hold the mandible in a forward position, and it is accepted that muscle forces have an effect as they attempt to return the mandible to its normal rest position. It is logical to suggest that these muscle forces are transferred to the teeth and thence to the bone, and that this in turn produces a restraining effect on the maxilla and a stimulating growth effect on the mandible.[9] Andresen and Haupl's appliance was intended to re-educate the oral musculature. It was loose fitting, and they believed that repeated closure into a forward bite with the so-called 'exercise appliance' helped to achieve the required re-education.

The effect of passive tension of the soft tissues

Interestingly, a landmark study was published in 1994 by Noro and coworkers[10] and they were able to show that passive tension of the surrounding soft tissues is much more important than muscle contraction in producing changes. Strain measurement, electromyography (EMG), and electroencephalography (EEG) were used to investigate the type of force produced by activators. Measurements were carried out on 15 Class II patients with a mean age of 10 years and 5 months wearing activators, and it was found that 'passive tension' produced by the adjacent soft tissues was very important. It was concluded that this 'viscoelasticity of the soft tissues' was much more significant in producing changes than the occasional active contraction of the jaw-closing muscles (Fig. 5.6).

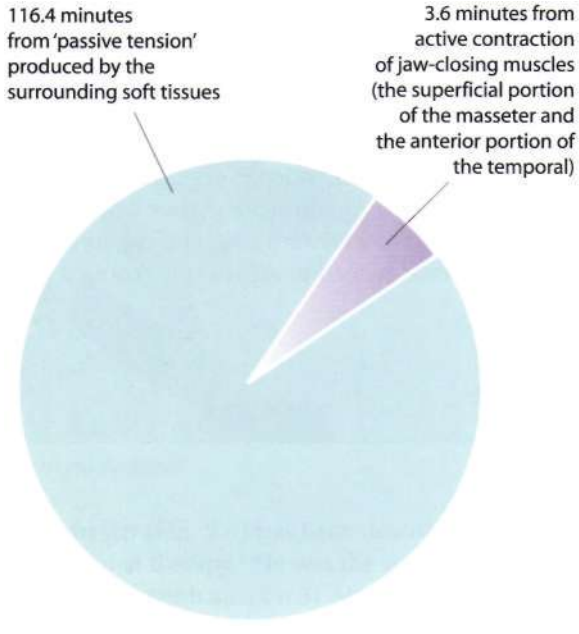


Fig. 5.6 The duration of forces on the activator during a 120-minute sleep period.[10] Passive tension of the surrounding soft tissue has been found to be more important than muscle contraction.

The effect of different amounts of bite opening

In the 1994 study[10] Noro and coworkers also investigated the effect of different amounts of bite opening in the activator construction bite using opening at the incisors of 2 mm, 4 mm, 6 mm and 8 mm. They found that an increase in bite opening produced an increase in the magnitude of force obtained from passive tension of the soft tissues (Fig. 5.7), and a slightly more favorable direction of force.

However, the research findings need to be balanced against clinical factors. Patients generally find appliances easier to wear with a modest construction bite of 2-4 mm at the incisors. This produced 80-100 Gm of force in the Noro study, and clinicians may feel this is adequate for successful treatment. A more open construction bite will deliver more force, but may make compliance difficult for the child.

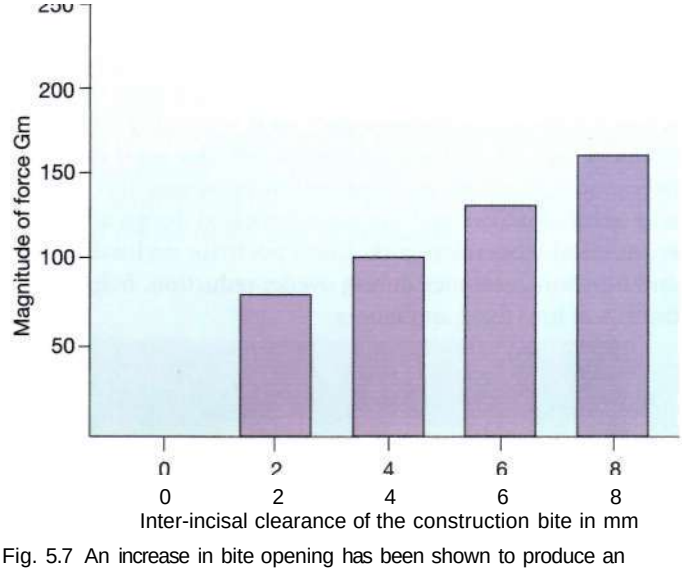


Fig. 5.7 An increase in bite opening has been shown to produce an increase in the magnitude of force obtained from passive tension of the soft tissues, but excessive bite opening can reduce compliance as the appliance becomes more difficult to wear.

WHAT CHANGES ARE PRODUCED BY FUNCTIONAL APPLIANCES?

As discussed above, it is helpful to the clinical orthodontist to have information about how the Andresen achieves its effect. This knowledge brings advantages in appliance design (for example, the height of the construction bite) and in patient management (for example, the value of passive tension compared with active muscle contraction).

It may be less important for the clinician to have a detailed knowledge of the research about the precise changes that the *Andresen produces, because this varies so much from case to* case. Each individual will respond differently to functional appliance wear. Some will show excellent growth, but in others the changes will be mainly due to tooth movement (Fig. 5.8).

There are many investigations about the changes that activators produce, but it is difficult to study scientifically because of the variables. These include appliance design, construction bite, cooperation levels, growth factors, control groups, and the severity of the starting malocclusion. Also, the research generally reports mean values for groups of individuals, and this information is of limited help to the clinical orthodontist, due to the wide variations in individual response. Readers wishing to study the subject will find good *review papers available as starting points, for example* Bishara and'Ziaja 1989,[8] Aelbers and Dermaut 1996,[u] King et al 1990,[12] and Barton and Cook 1997.*

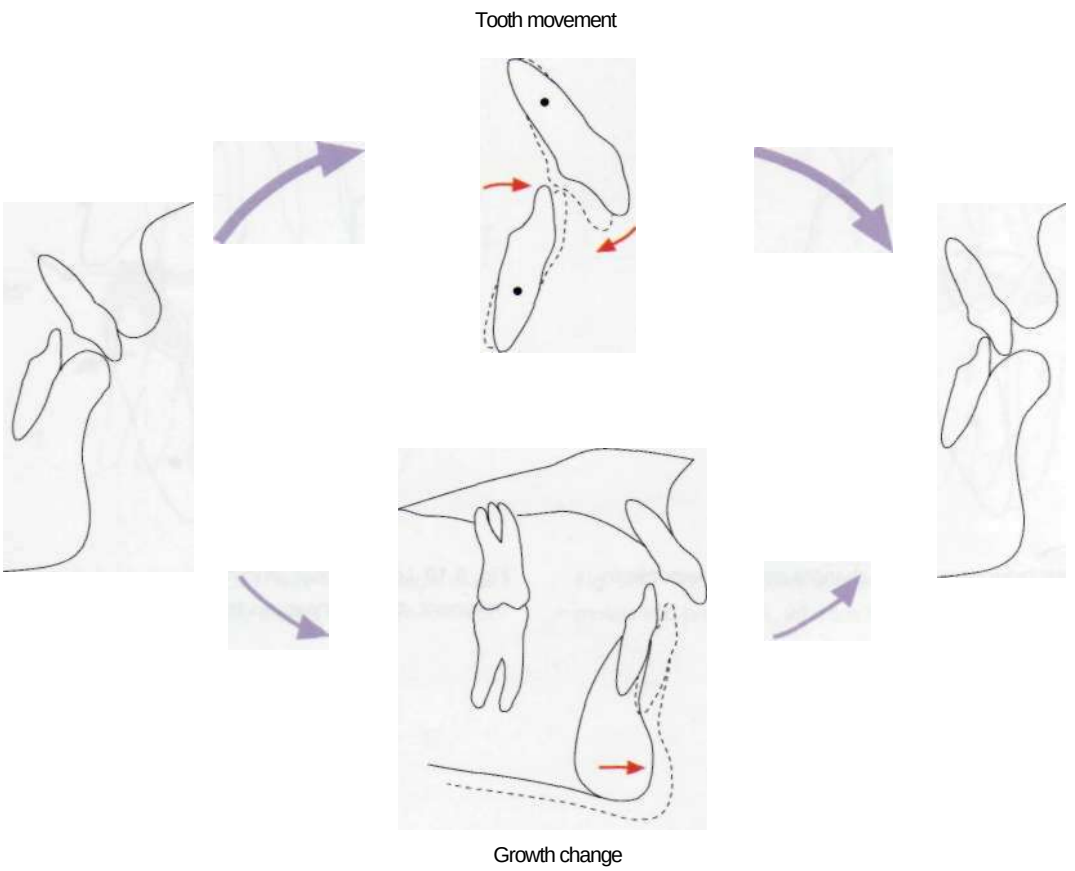


Fig. 5.8 During Andresen wear some children will show excellent growth, but for others the changes will be mainly due to tooth movement. The balance will vary between individuals and due to differences in appliance design. Research has shown that no increase in mandibular prognathism can be accomplished beyond the amount that could be expected by physiological growth.

THE DENTAL CHANGES PRODUCED BY THE ANDRESEN APPLIANCE

As early as 1951 Bjork published[13] a detailed assessment of activator treatment with a careful cephalometric analysis of the effects produced. As he was a world authority on cephalometry, he was well placed to publish on the topic, and being Danish he presumably had access to excellent Andresen cases. He concluded that the changes were only dentoalveolar and ' ... mainly confined to re-shaping of the dental arches.'

The incisor changes

It is accepted that incisor torque changes occur in response to wearing the Andresen appliance. Although growth is helpful in some cases, successful overjet reduction with functional appliances requires some retroclination of upper incisors and/or proclination of lower incisors (Fig. 5.9).

There are appliance designs that are intended to limit these incisor torque changes but there is little evidence that they are effective, and it has been shown that lower incisor proclination occurs in functional appliance treatment, despite measures to prevent it (Fig. 5.10).

Weschler and Pancherz compared different types of lower arch anchorage in Herbst treatment.'[4] They measured mandibular anchorage loss, including proclination of lower incisors, and found (surprisingly) that cast splint anchorage was no better than banded methods. Loss of anchorage was found in all cases, with between 5.5 and 9.7 degrees of proclination of lower incisors.

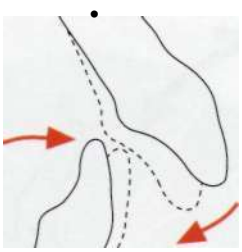


Fig. 5.9 Well-documented incisor torque changes occur in response to wearing the Andresen appliance.

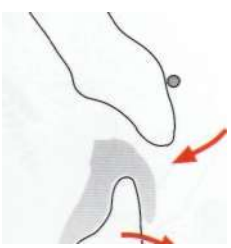


Fig. 5.10 Lower incisor proclination occurs during functional appliance treatment, despite measures to prevent it.

The vertical molar changes

The design of the Andresen appliance allows removal of occlusal acrylic above the lower molars and premolars. This design feature encourages upward and forward eruption of the lower molars (Fig. 5.11) and makes the Andresen a Logical choice for low-angle Class II division 1 cases, where there is a need for the molars to be free to erupt into the freeway space. Lower molar eruption of this type is assumed to be a favorable factor in correcting the Class II molar relationship and reducing deep incisor overbites.

In contrast, the Twin Block appliance can have the effect of intruding molars and premolars,[15] and is a logical choice for higher angle cases (Fig. 5.12). A lateral open bite may be typically seen after overjet correction with the Twin Block appliance (Figs 5.13, 5.14 & 5.15).

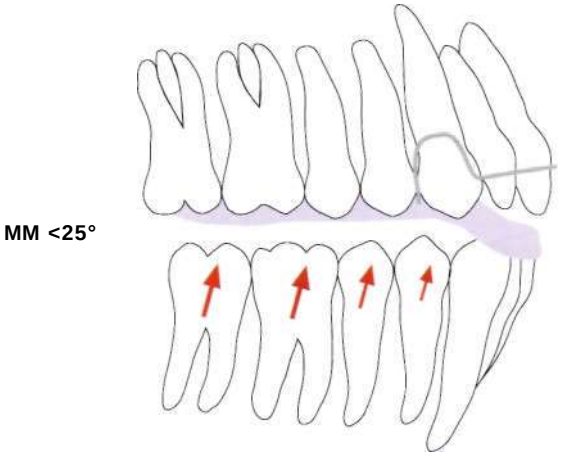


Fig. 5.11 The Andresen appliance is a logical choice for low-angle Class I **division** 1 cases, where there is a need for the molars to be free to erupt.

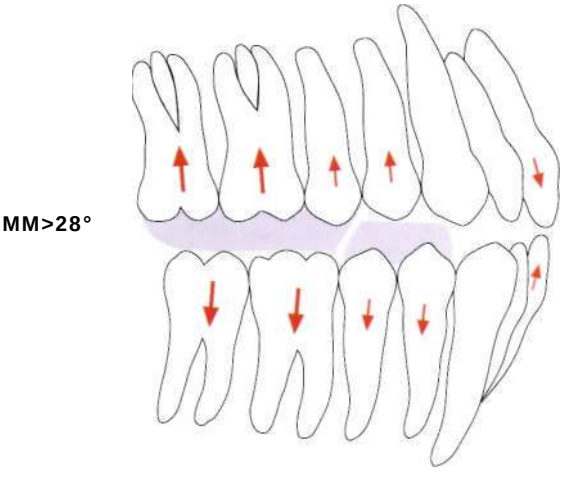


Fig. 5.12 The Twin Block appliance can have the effect of intruding molars and premolars, which is helpful for higher angle cases.

Harvold and Vargervik[16] measured mandibular alveolar height from the highest point on the occlusal surface of the lower left first molar to the lower border of the mandible. The appliances in their study were trimmed to remove acrylic above lower molars, and they found an average increase of 1.6 mm compared with 0.4 mm in the control group. The effect on lower face height is discussed later in this chapter (page 65).

Upper molar expansion

Normally some expansion occurs in the upper molar regions in response to wearing an Andresen appliance. This will be greater if the Andresen has passive acrylic eruption grooves (page 36), or the design includes an expansion screw, or a Coffin spring. Upper torque changes occur during molar expansion and these need to be corrected with fixed appliances (page 36).

Fig. 5.13

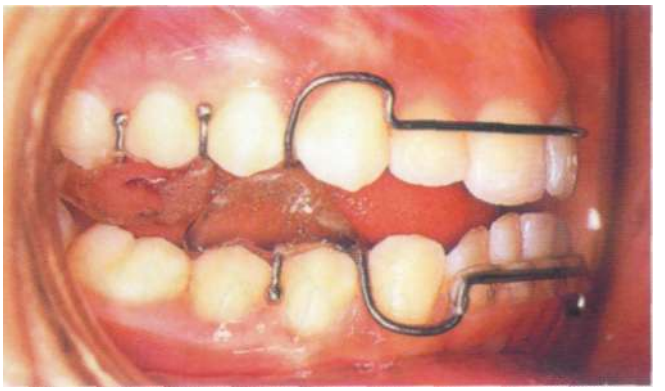


Fig. 5.14

Fig. 5.15

Figs 5.13 to 5.15 This sequence of photos shows a Twin Block case[15] before, during, and after wearing of the functional appliances, with a typical lateral open bite due to molar and premolar intrusion.

THE SKELETAL CHANGES PRODUCED BY THE ANDRESEN APPLIANCE

Mandibular growth

When treating Class II malocclusions it would be helpful to orthodontists to be able to use functional appliances to stimulate significant mandibular growth, beyond the amount that would naturally occur. In the early years this seemed to be a possibility, because very favorable mandibular changes were seen in some cases treated with activator, Frankel or Harvold appliances, often worn over long periods. This suggested that functional appliances may be capable of stimulating mandibular growth, and that the genetically determined skeletal pattern could somehow be improved in this way.

Unfortunately, subsequent research has not been able to support this idea. For example, Nelson and his coworkers[17] concluded that: 'We could find no evidence to support the view that either the Frankel appliance or the Harvold activator was capable of altering the size of the mandible.' More recently Aelbers and Dermaut[11] concluded that: there is still no scientific evidence that one can induce a clinically significant long-term orthopedic effect through activators ... .'

A consensus has emerged that suggests that the Andresen appliance has a skeletal effect, but that any mandibular growth is not in excess of the genetically determined amount (Fig. 5.16). For example, in 2001 Ruf et al reviewed[18] 40 Andresen activator cases and concluded that' ... effective condylar growth and the chin position can be affected by activator treatment. This implies that activator therapy has a skeletal effect.' However, it was noted that' ... no increase in mandibular prognathism could be accomplished, beyond the amount which could be expected by physiological growth.'

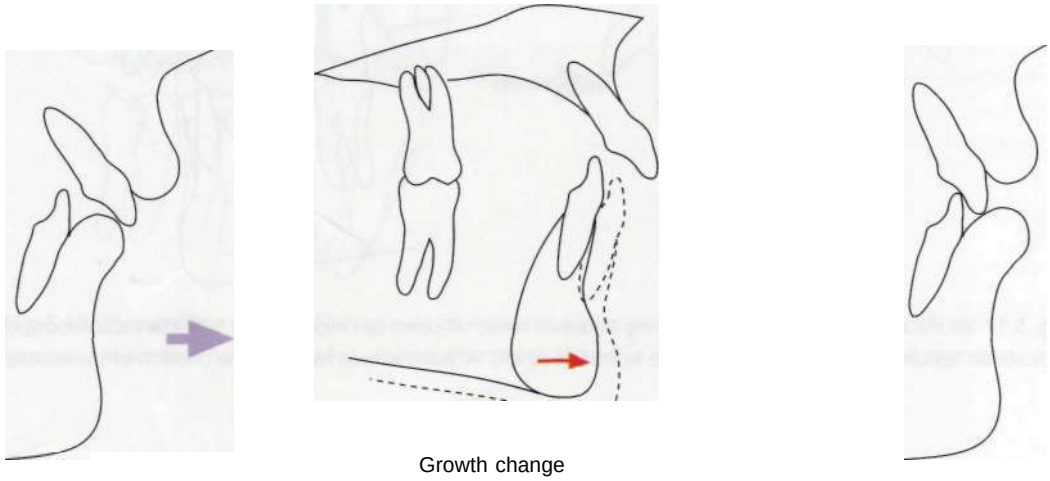


Fig. 5.16 Part of the overjet correction occurs because the Andresen appliance has a skeletal effect, but there is increasing evidence that any mandibular growth achieved is not in excess of the genetically determined amount.

Growth of the maxilla

McNamara[19] has maintained that the most frequent skeletal problem in Class II malocclusions is a retrognathic mandible. This view is supported by experience in clinical practice, where most average or low-angle Class II division 1 cases look better facially at the start of treatment when the patient holds the mandible in a protruded position (see page 31). Therefore, for most patients it is not logical to try to restrict maxillary growth with an Andresen appliance, although there is some evidence that it may occur anyway.

In a far-reaching review paper, King and coworkers[12] quote references indicating that functional appliances restrict forward horizontal growth of the maxilla. However, this is a difficult research area because of unreliability in measuring A/P changes in the maxilla. For example, upper incisors retrocline during Andresen wear, and 'A point can move distally with the incisor roots (Fig. 5.17). This indicates an apparent maxillary skeletal change in studies where 'A point is used to assess the position of the maxilla.

In an early paper, Harvold and Vargervik[16] measured from TMJ (temporomandibular joint) to ANS (anterior nasal spine) to assess maxillary position changes during Andresen wear, and found reduced forward growth, noting that this was supported by Jacobsson's earlier study[20] A recent study concluded that the activator encouraged mandibular growth but had little restraining effect on the maxilla.[37]

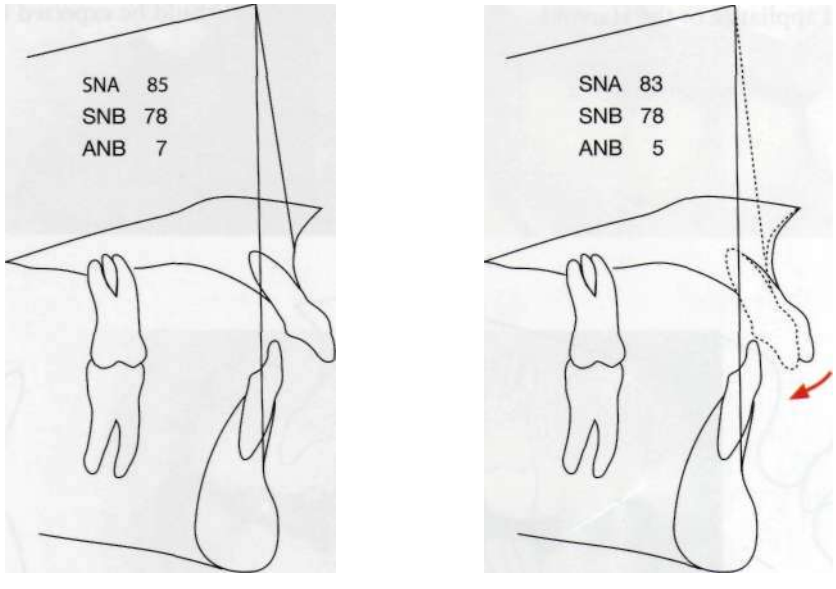


Fig. 5.17 As the upper incisors retrocline during Andresen wear, 'A point can move distally with the incisor roots, to indicate an apparent maxillary skeletal change in studies where 'A point is used to assess the position of the maxilla.

Changes in lower face height

An increase in lower face height is desirable when treating a low-angle 'overclosed' Class II division 1 malocclusion, for example Cases MZ and DI (pages 114 and 134). As discussed below, there is some evidence that wearing an Andresen appliance can be associated with a significant increase in lower face height, provided acrylic is trimmed to allow free eruption of lower molars and premolars (Fig. 5.18).

Ahlgren and Lauris[21] reported on 50 cases treated in Malmo with Andresen activators. They were trimmed 'according to the original Andresen ideas' to free the lower molars from acrylic contact, and the bite was taken 2 mm below and 5 mm ahead of the mandibular rest position. A significant increase in lower face height was reported, noting a 'most favorable bite-raising effect.'

Harvold and Vargervik[16] measured ANS to GN (gnathion) in 20 subjects wearing activators with acrylic trimmed to allow unrestricted eruption of lower molars. They found a 2.2 mm increase in lower face height compared with only 0.75 mm in a control group. In contrast, a study by Weislander and Lagestrom[22] investigated a group of Andresen cases where the acrylic was not trimmed above the lower molars, and found only 0.5 mm of molar eruption on average, reporting no significant increase in lower face height. This suggests that acrylic trimming may be important for the low-angle cases.

In a 2001 study[18] the respected research team of Ruf et al carefully reviewed 40 successful Andresen activator cases in which the acrylic had been trimmed in the molar regions.

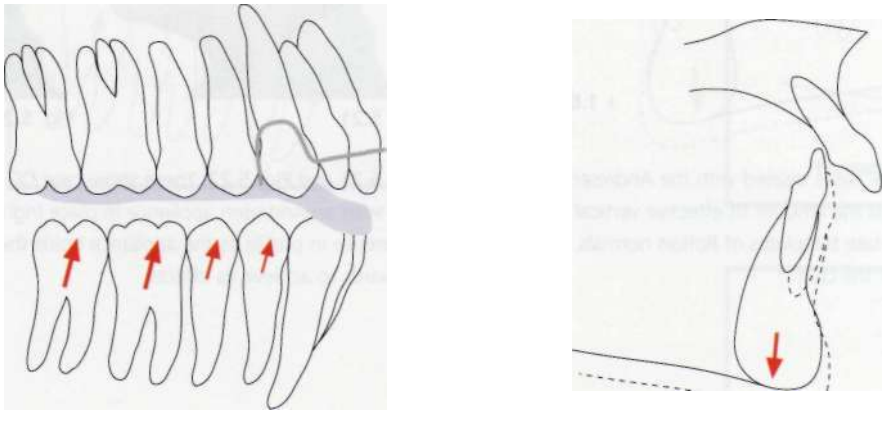


Fig. 5.18 There is some evidence that wearing an Andresen appliance can be associated with a significant increase in lower face height, provided acrylic is trimmed to allow free eruption of lower molars and premolars.

The cases treated with the Andresen appliance showed an increase in the amount of effective vertical condylar growth (3.00 mm, P < .001) compared with the acetate templates of Bolton normals (Fig. 5.19), and a greater vertical development of the chin (1.8 mm, *P* < .001). They noted large individual variations, commenting that the changes tended to be 'more extensive in the male subjects, especially in the vertical direction.' While it is generally accepted from research papers that the MM angle typically remains unchanged throughout a conventional orthodontic treatment, it is possible for the linear measurement of lower face height to increase without MM angle increasing.

The Andresen appliance is effective in reducing overjets and overbites in selected cases (Fig. 5.20). It produces mainly dentoalveolar changes, but favorable mandibular growth occurs in some cases as a bonus. It has not been possible to show that these growth changes are in excess of the genetically determined growth for the individual, or to predict which cases will grow and which will not. If acrylic is trimmed above the lower molars, there is an associated increase in lower face height in some cases (Figs 5.21 & 5.22).

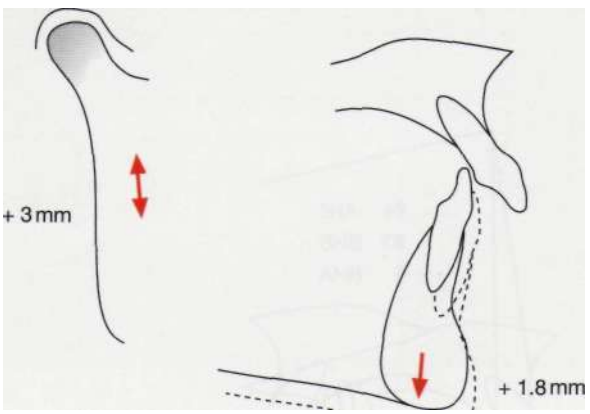
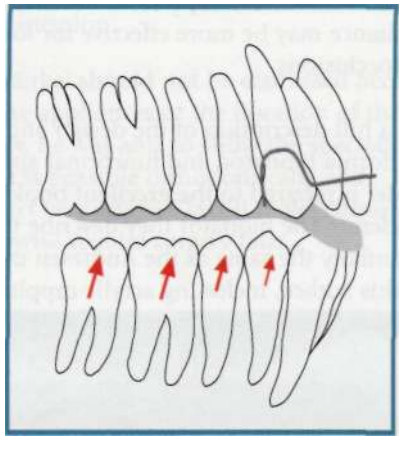
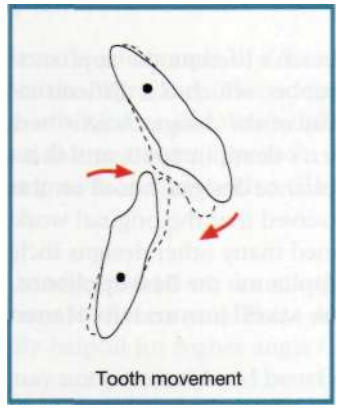


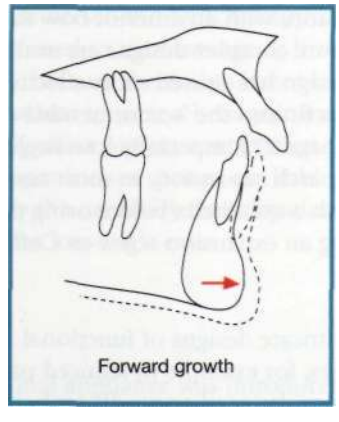
Fig. 5.19 In a study by Ruf et al cases treated with the Andresen appliance showed an increase in the amount of effective vertical condylar growth compared with the acetate templates of Bolton normals, and a greater vertical development of the chin.[18]

Fig. 5.21 and Fig. 5.22 These show case OD with teeth in occlusion (left) and with an Andresen appliance in place (right). There is a vertical difference in profile as the appliance holds the mandible downwards and forwards to achieve its effects.

SUMMARY OF THE CHANGES PRODUCED BY THE ANDRESEN APPLIANCE







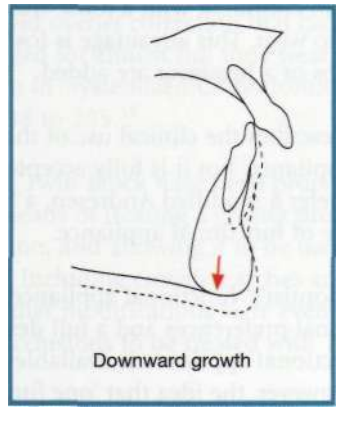


Fig. 5.20

FUNCTIONAL APPLIANCE DESIGNS

The advantages of the basic Andresen design

During Andresen's lifetime the appliances were made of vulcanized rubber, which is a difficult material that restricted the complexity of the design. Acrylic became available soon after Andresen's death in 1950, and this allowed more complex appliance designs, based on the same principles. It has been observed that the original work of Andresen and Haupl spawned many other designs including the Bionator, the Bimler appliance, the Bass appliance, the Herbst appliance, the Maxillator, and the Herren and Teuscher activators.[2]

This book describes cases treated with the Andresen appliance in its simplest form - a one-piece, loose-fitting acrylic appliance with an anterior bow for the upper incisors. Although more complex designs are available, the basic Andresen design has proved most effective when treating patients who fit into the 'recommended criteria' described in Chapter 3 (page 27), especially low-angle cases. If a case needs upper arch expansion, in most cases this can be achieved with a quadhelix before using the Andresen, to avoid adding an expansion screw or Coffin spring to the appliance.

The more intricate designs of functional appliance can have disadvantages, for example in reduced patient cooperation, because a complex appliance will probably be more difficult to wear, and carry an increased risk of breakages. Also, children seem confident with a loose-fitting appliance, and find it easy to wear. This advantage is lost if design features such as clasps or a headgear are added.

This book describes the clinical use of the unmodified Andresen appliance, but it is fully accepted that many clinicians prefer a modified Andresen, a Herbst, Twin Blocks or other type of functional appliance.

Each orthodontist's 'functional appliance of choice' will reflect personal preferences and a full description of different types of functional appliance is available in other excellent texts.[23"25] However, the idea that 'one functional appliance design fits all' is open to question. Therefore some widely used functional appliances are briefly reviewed below in order to discus possible advantages and disadvantages compared to the basic Andresen.

The bionator appliance

This is sometimes called Baiter's bionator[26] and has been recommended for use in various modified forms, for example Ascher's bionator[27] or the California bionator.[23]

In its various forms the bionator is very similar to the Andresen, but has more wire and less acrylic (Figs 5.23 & 5.24), and is entirely suitable to treat 'recommended criteria' patients described in Chapter 3. It can require more wire-bending skill during adjustment, and there is a greater risk of wire distortion if carelessly handled by the patient. Like the Andresen, removal of acrylic in the buccal segments can allow unrestricted eruption of molars, and therefore the appliance may be more effective for low-angle Class 11/1 malocclusions.

For a full description of the design and construction of the California bionator, and functional appliances generally, the reader is referred to the excellent book by McNamara and Bruden.[23] The bionator they describe in Chapter 18 is essentially the same as the Andresen used and recommended by this author, including acrylic capping of the lower incisors, but has wire instead of acrylic in the palate area.

Fig. 5.23

Fig. 5.24

The Frankel appliance

There was huge interest, verging on disbelief, when Frankel began showing his cases to the orthodontic specialty in the 1960s.[29,30] His appliance designs were complex (Fig. 5.25), and patients wore them for many years, but the cases showed remarkable levels of facial improvement.

Despite the early enthusiasm, the Frankel method of treatment has not seen widespread acceptance, possibly because it requires special skills from the orthodontist and unacceptably high levels of cooperation from the patient, over long periods of time. Also, the appliances are complex and expensive for the technicians to make, and are liable to frequent breakage or distortion.

The contribution of Frankel should not be dismissed because of the complexity of the appliances or the duration of the treatments. Remarkably, he was able to show the specialty that in selected cases it is possible orthodontically and orthopedically to correct very severe Class II malocclusion - cases that would otherwise require surgery later.

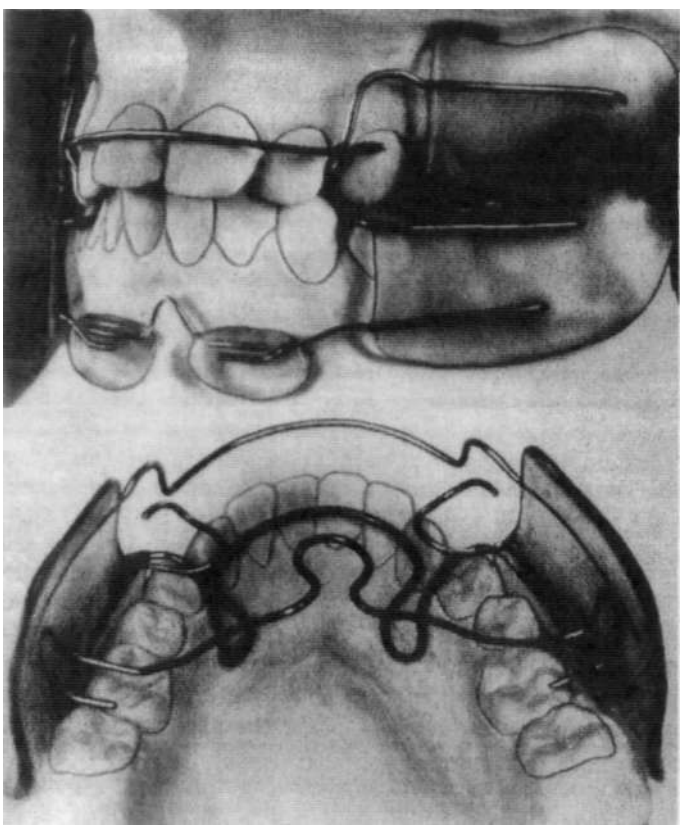


Fig. 5.25 Drawings of the Frankel appliance taken from: Treatment of Class II, division 1 malocclusion with functional correctors: (With permission; American Journal of Orthodontics[30])

The Teuscher appliance

The Teuscher[28] appliance is an example of a 'headgear activator' type of functional appliance. The extensive chapter by Stockli and Teuscher in Graber and Vanarsdall's book[25] gives full details about this treatment approach, which is intended to influence growth in cases with a Class II skeletal problem.

The appliance has a headgear to act on the maxilla, and springs for upper incisor torque control. These design features are potentially helpful for higher angle Class 11/1 malocclusions, but may not be considered beneficial when treating low-angle uncrowded Class 11/1 patients.

Compared with the Andresen the Teuscher appliance may have disadvantages if used to treat average or low-angle patients (Chapter 3), because the design is not loose fitting and it requires the patient to wear a headgear, and these features can adversely affect patient cooperation. Also, with some patients the upper incisor springs are liable to break or distort, and can delay the necessary retroclination of the upper incisors in some low-angle cases.

Twin Blocks

This two-part functional appliance was introduced by Clark in the early 1980s and is described in detail in his book.[31] It is widely used in the UK, where it was developed, and users comment on the rapid overjet correction that can be achieved. It is intended for almost full time wear, and a treated case is shown in 'Systemized Orthodontic Treatment Mechanics,' pages 198 to 205.[32]

Modifications to the Twin Block have been proposed over the past 20 years 'as a means of treating a greater proportion of the Class II population, and allowing it to be used for more severe Class II cases, including crowded arches and Class II/2 malocclusion.'[33] Further modifications were even suggested to allow Class III malocclusions to be treated with Twin Blocks.[31]

The disadvantages of Twin Blocks compared with the Andresen

The Twin Block appliance may be regarded as a good treatment option for higher angle Class II division 1 malocclusions, and preferable to the Andresen appliance for these cases, due to its ability to intrude the buccal segments. For routine and lower angle Class II division 1 cases the Andresen may be preferable.

Compliance issues

Compared with the Andresen, Twin Blocks involve two appliances instead of one, with a requirement for 24 hours of wear compared with 10 hours. If we ask a typical patient, Would you prefer to wear two appliances full time, or just one appliance during the evenings and at night?' most will prefer the 10-hour, one-appliance option.

Tooth movement versus skeletal change

It is widely accepted in orthodontics that functional appliances achieve their effect by a combination of tooth movements and skeletal change, and that skeletal change can be expected to produce greater facial improvement. It is also accepted that a 24-hour force gives more effective tooth movement than a 10- to 12-hour force. Twin Blocks will theoretically produce more dental change than the Andresen due to the 24-hour force, and advocates of the Twin Block appliance comment on the rapid correction of overjets. One can speculate that this involves more dentoalveolar change than with an Andresen, with possibly less favorable skeletal change (and hence less facial improvement).

Lower face height

The full-time wear of two blocks of buccal acrylic has an intrusive effect in the molar regions (Fig. 5.26). This is a theoretical advantage for high-angle malocclusions, but a disadvantage for low-angle over-closed Class 11/1 cases. Here the Andresen can be more effective, because it allows unrestricted lower molar eruption. It has been suggested that acrylic can be trimmed from the twin block appliance[31] to allow molars to erupt, but this can be time consuming and difficult to achieve (Fig. 5.27).

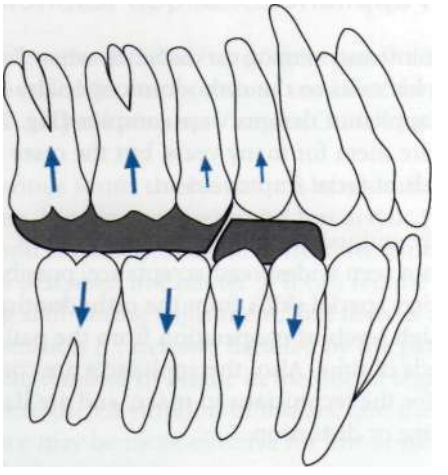


Fig. 5.26 The full-time wear of the two blocks of buccal acrylic, which comprise the Twin Block appliance, has an intrusive effect in the molar regions. This is a theoretical advantage for high-angle malocclusions, but a disadvantage for low-angle over-closed Class 11/1 cases.

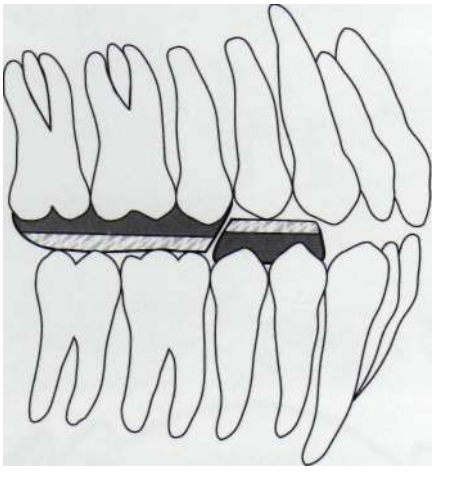


Fig. 5.27 Acrylic can be trimmed from the Twin Block appliance to allow molars to erupt, but this can be time consuming and difficult to achieve.

Ease of transition into the fixed stage of treatment

After overjet correction with Twin Blocks there is normally a lateral open bite, and a lack of buccal occlusion (Fig. 5.28). This is can cause a lengthy and more difficult transition into fixed appliances after Twin Blocks when compared with transition from the Andresen.

In contrast, during treatment with the Andresen appliance, normal occlusal tooth contact continues in the molar regions.

Various methods have been proposed for managing the lateral open bite after Twin Block treatment. These include the gradual trimming down of the bite blocks over several months, or the wearing of a removable acrylic appliance with a deep, steep, bite plane, but it is accepted that the transition into fixed appliances can be lengthy and difficult in some cases.

Fig. 5.28 After overjet correction with Twin Blocks there is normally a lateral open bite, and a lack of buccal occlusion.

The Herbst appliance

The Herbst appliance was introduced by Emil Herbst in 1905, and reintroduced by Pancherz in 1979.[34] It is a widely used method of treating Class II division 1 malocclusion, and has been advocated and extensively investigated by Pancherz and coworkers. As with other functional appliances, the Herbst is used with many design variations, all of which follow the same basic principle (Fig. 5.29).

Removable functional appliances require good patient compliance, and the Herbst has the advantage that it needs less patient cooperation. However, it is more complicated and expensive than an Andresen and, although it is an effective method of reducing overjets, clinical experience suggests that frequent breakages occur.

Research evidence supports the view that the Herbst appliance is prone to debonding and component breakage,[35] noting that the benefit of reduced compliance needs to be balanced against the additional cost of appliance construction and the extra visits for appliance repair. It has also been noted that when a Herbst appliance fractures or becomes detached, the chair-side time needed for repair can be excessive.[36]

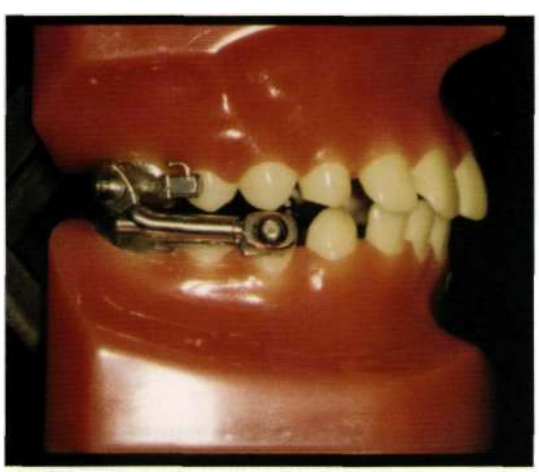


Fig. 5.29 The Herbst is used with many design variations, all of which follow the same basic principles.

LABORATORY TECHNIQUE

Some of the technical aspects of construction of the Andresen appliance are shown here.

The impressions are poured in stone and carefully mounted on a plane line articulator, ensuring that the bite is correct (Fig. 5.30). After mounting, the models should be in exactly the same relationship as recorded by the wax bite taken at the chair side and previously checked on the study models (Figs 5.31 & 5.32).

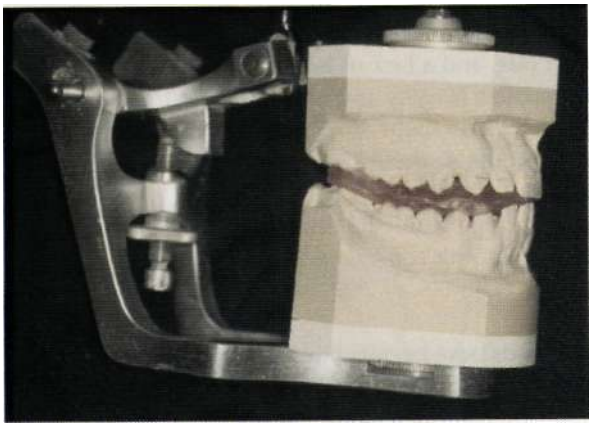


Fig. 5.30

The upper and lower models are duplicated (or a second pair of models can be poured from the impressions if they are not damaged) and blue colored plaster is used to build up the lower working model in the area occlusal to the molars and premolars (Fig. 5.33).

After the blue plaster has set, a Biostar™ vacuum-forming machine (Fig. 5.34) is used to suck down a 3 mm disc on to each of the working models (Fig. 5.35).

Fig. 5.34

The vacuum-formed upper and lower plates are then trimmed and polished (Fig. 5.36) and a wire is prepared in 0.8 mm round stainless steel (Fig. 5.37).

The upper and lower plates are then returned to the articulator and the wire is positioned using sticky wax. It is helpful if a small groove is made in the plaster of the upper incisors at the point where the bow will lie. With the articulator closed the appliance may then be completed by joining the two plates together using acrylic followed by the normal finishing and polishing (Fig. 5.38).

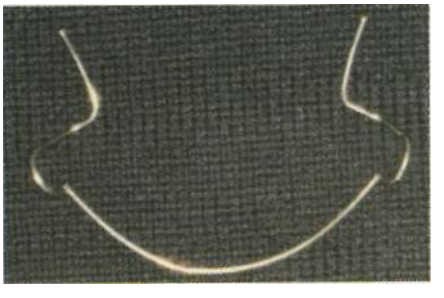


Fig. 5.37

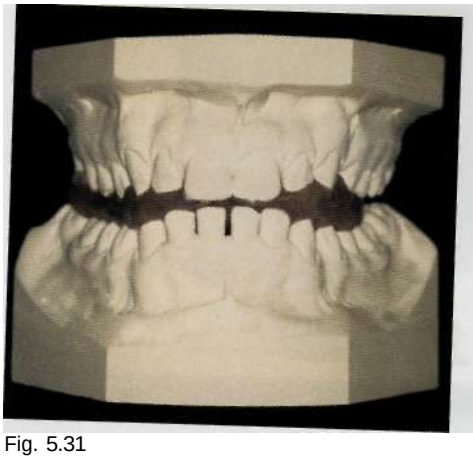


Fig. 5.31

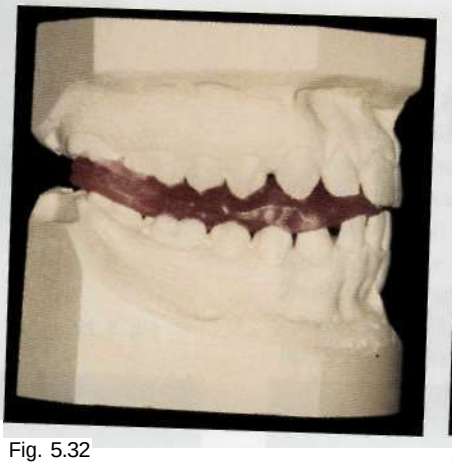


Fig. 5.32

Fig. 5.33

Fig. 5.35

Fig. 5.36

Fig. 5.38

CASE OD

This boy was first seen at age 11.7 years (Fig. 5.39) and the family were advised to wait for half a year until the late mixed dentition, because nine primary teeth were present, most of which were close to being shed. He was seen again at age 11.11 years (Figs 5.40, 5.41) with a Class II division 1 malocclusion on a slightly low-angle pattern, with MM angle of 24 degrees. At that time only two primary teeth remained. Skeletally the case was Class I based on the ANB angle of 4 degrees but had a Wits value of 4 mm, indicating mild Class II bases. The family was originally from Czechoslovakia, but living in London.

Dentally, the patient showed an uncrowded Class II division 1 malocclusion with an overjet of 11.5 mm, and an upper midline diastema of 1.5 mm, with a minor left-side crossbite (Figs 5.42, 5.43, 5.44, 5.46, & 5.47). Upper incisors were very proclined. It was felt that cooperation would be good in this case, as the family were concerned about the lack of facial harmony and anxious for this to be improved. This case almost fully met the recommended case selection criteria (page 27).

Fig. 5.48

Fig. 5.39

Fig. 5.42

Fig. 5.45

The first Andresen (Fig. 5.45) was constructed using a wax bite with the mandible protruded approximately 8 mm and with above average 6 mm of opening at the incisors, to encourage an increase in lower face height. It was fitted at age 12.1 years and was worn for 10 months. The bow was passive and positioned half way up the labial surface of the upper incisors. The lower molars and second premolars were free to erupt. The original treatment planning was for a second Andresen appliance to be used, but this was not required, as it proved possible to reduce the overjet fully using the original one, after a slightly slow start.

Fig. 5.40

Fig. 5.41

Fig. 5.43

Fig. 5.44

Fig. 5.46

Fig. 5.47

Case OD age 11.11	
SNA	86°
SNB	82°
ANB	4°
Wits	+ 4 mm
MM	21°
U1 to Max plane	138°
L1 to Mand plane	94°

Fig. 5.49

Fig. 5.50

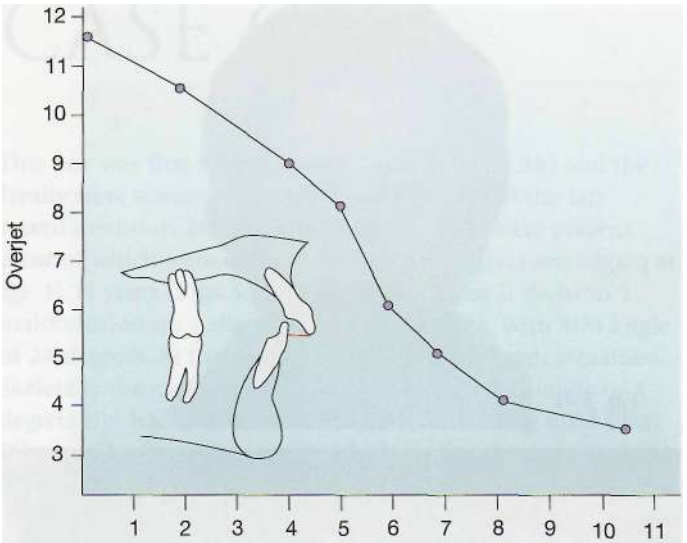


Fig. 5.51

The overjet was reduced from 11.5 mm to 3.5 mm using only the one Andresen appliance for 10 months (Fig. 5.51). The molars and premolars were in Class I relationship with the upper incisors under lip control (Figs 5.52, 5.53, & 5.54), and the patient was reminded of the need to maintain a lip seal. Understandably, patients sometimes ask to cease treatment at this stage!

Full-size metal upper and lower fixed appliances were placed at age 12.11 years. The opening archwires were .014 round steel and these were replaced by upper and lower .018 round steel wires at the first adjustment visit at age 13.0 years (Figs 5.55, 5.56, & 5.57). At this stage light Class II elastics (80 Cm) were being worn during sleeping hours to hooks bent into the upper archwire, but Kobayashi hooks or other methods could have been used for the elastics (page 128). Very light elastic chain was being used to close space in the lower arch mesial to first premolars, and the brackets of these teeth were tied to prevent rotations. Passive elastic chain was in place across the upper incisors.

At age 13.1 years a normal upper steel rectangular .019/.025 working wire was placed, with a .020 round wire in the lower, and light Class II elastics were continued at night (Figs 5.58, 5.59, & 5.60). The upper wire was expanded to correct the slight left-side crossbite (Fig. 5.61). At age 13.3 years lower canine brackets were repositioned more mesially and the lower arch was realigned. A lower rectangular steel .019/.025 working wire was in place from age 13.5 years until the fixed appliances were removed at age 13.7 years.

Fig. 5.52

Fig. 5.55

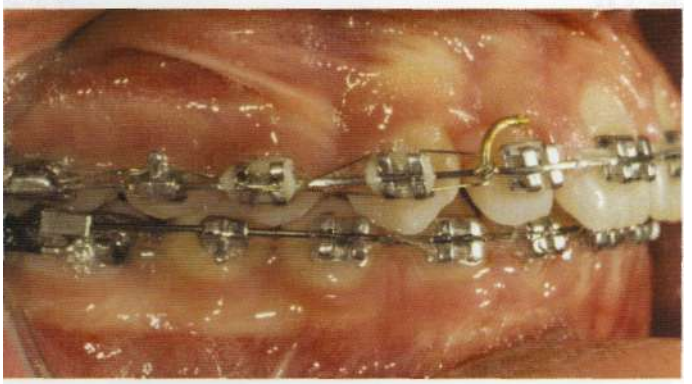


Fig. 5.58

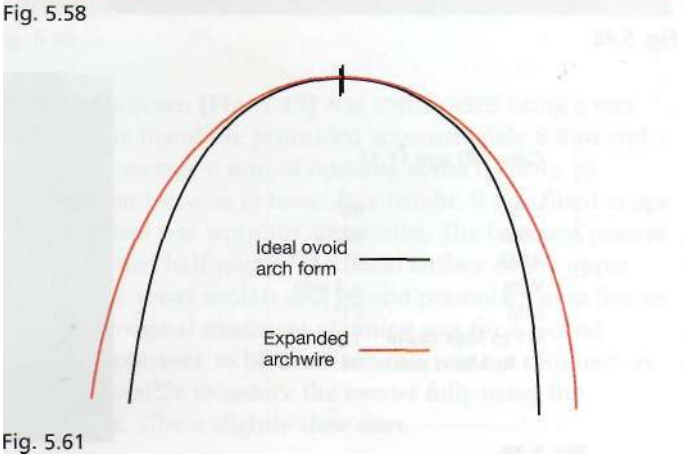


Fig. 5.61

Fig. 5.53

Fig. 5.54

Fig. 5.56

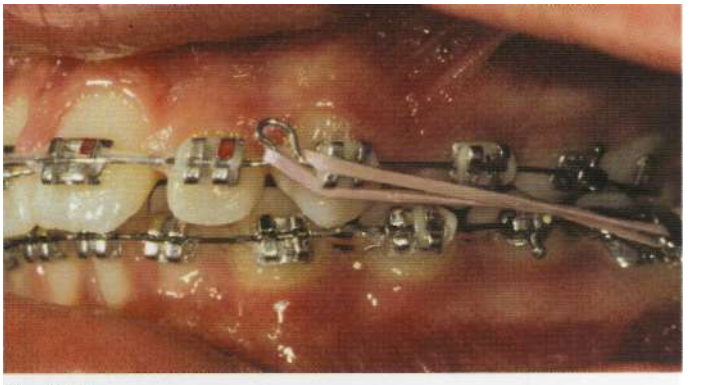


Fig. 5.57

Fig. 5.59

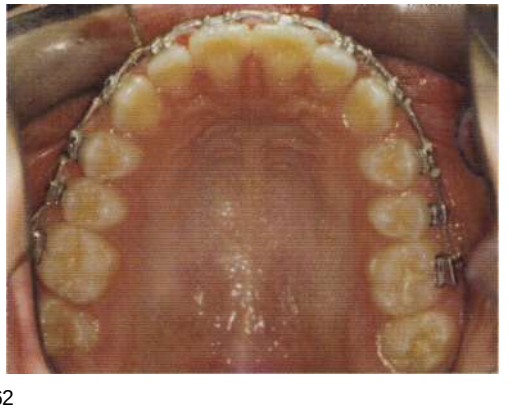


Fig. 5.62

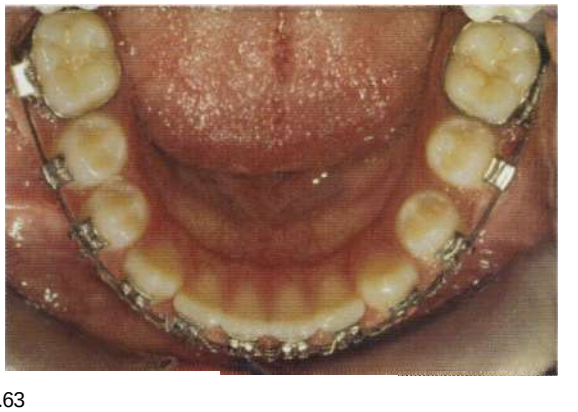


Fig. 5.63

At the end of treatment at age 13.7 years the patient had much improved facial harmony (Figs 5.64, 5.65, & 5.66), and this had been the main reason for seeking treatment. Interestingly, the three-quarter smile view (Fig. 5.70) suggests slight retrognathism, which supports the view that headgear is generally not beneficial in this type of case.

A tooth positioner was used for 4 weeks before proceeding into normal retention at age 13.8 years, leaving a pleasing Class I dentition (Figs 5.67, 5.68, 5.69, 5.71 & 5.72). The minus 7 degrees of upper canine torque seems to work well in individuals with broad dental arches of this type, but zero torque canine brackets can be considered for cases with narrower arches.

Cephalometrically the measurements were close to ideal.

Fig. 5.64

Fig. 5.67

Fig. 5.70

Fig. 5.73

Case OD age 13.7

SNA	84°
SNB	82°
ANB	2°
Wits	-3 mm :
MM	21°
U1 to Max plane	118°
L1 to Mand plane	98°

Fig. 5.74

Fig. 5.65

Fig. 5.66

Fig. 5.68

Fig. 5.69

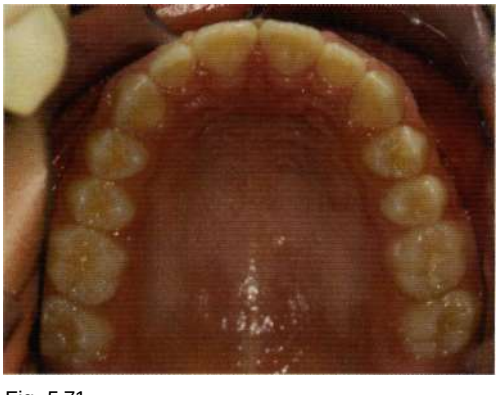


Fig. 5.71

Fig. 5.72

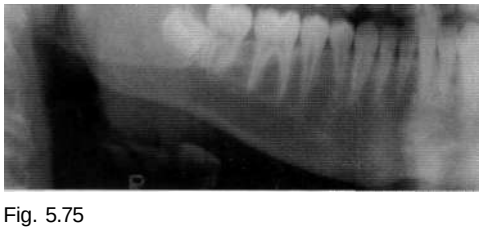
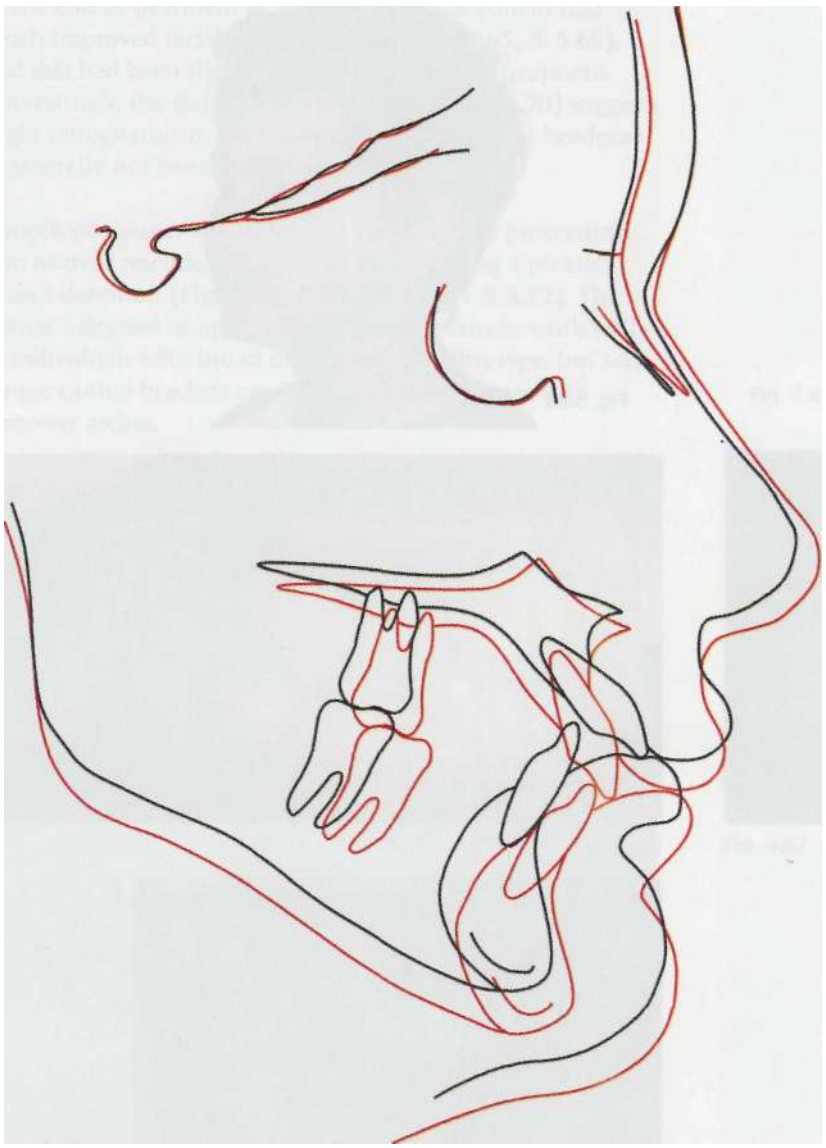


Fig. 5.75



Case OD	age 11 11	age 13.7
SNA	**86°**	84°
SNB	82°	82°
ANB	4°	2°
Wits	+ 4mm	-3mm
MM	21°	21°
U1 to Max plane	**138°**	**118°**
L1 to Mand plane	94°	98°

Fig. 5.76 Before and after tracings are shown at 80% of actual size, and are superimposed on sella-nasion line at sella. The changes which occurred in Case OD during a treatment lasting 20 months are rather typical of what is found in low angle Class 1/1 growing individuals. There has been an increase in lower face height which has contributed to the improvement in facial appearance.

REFERENCES

1 Barton S, Cook PA 1997 Predicting functional appliance outcome in Class II malocclusions: a review. American lournal of Orthodontics and Dentofacial Orthopedics 112:282-286

2 Ingelsson AM, Forsberg CM 1988 Tandliikar Tidningen 80:820-827

3 Andresen V, Haupl K 1936 Funktions-Kieferorthopadie. Die Grundlagen des 'norwegischen Systems.' Leipzig: H. Meusser

4 Robin P 1902 Demonstration pratique sur la construction et la mise en bouche d'un nouvel appareil de redressement. Revue Stomatologic 9:561-590

5 Andresen V, Haupl K, Petric L 1953 Funktions-Kieferorthopadie, 5th ed. Johann Ambrosius Barth, Munchen

6 Freunthaller P 1967 Cephalometric observations in Class II, division 1 malocclusion treated with the activator. Angle Orthodontist 37:18-25

7 GraberTM 1969 Current orthodontic concepts and techniques, Vol. 2. Philadelphia: WB Saunders, 839

8 Bishara SE, Ziaja RR 1989 Functional appliances: a review. American Journal of Orthodontics and Dentofacial Orthopedics 95:250-258

9 GraberTM, Neuman B 1984 Removable orthodontic appliances. Philadelphia: WB Saunders

10 Noro T, Tanne K, Sakuda M 1994 Orthodontic forces exerted by activators with varying construction heights. American Journal of Orthodontics and Dentofacial Orthopedics 105:169-179

lj/'Aelbers CM, Dermaut LR 1996 Orthopedics in orthodontics. Part 1, fiction or reality: a review of the literature. American Journal of Orthodontics and Dentofacial Orthopedics 110:513-519 .

12'King GJ, Keeling SD, Richard A, Hocevar RA, Wheeler TT 1990 The timing of treatment for Class II malocclusions in children: a literature review. Angle Orthodontist 60(2):87-97

13 Bjork A 1951 The principle of the Andresen method of orthodontic treatment, a discussion based on cephalometric analysis of treated cases. American Journal of Orthodontics 37:437-458

14 Weschler D, Pancherz H 2004 Efficiency of three mandibular anchorage forms in Herbst treatment: a cephalometric investigation. Angle Orthodontist 75:23-27

15 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh, Case TS pages 198-200

16 Harvold EP, Vargervik K 1971 Morphologic response to activator treatment. American Journal of Orthodontics 60:478-490

17 Nelson C, Harkness M, Herbison P 1993 Mandibular changes during functional appliance treatment. American Journal of Orthodontics and Dentofacial Orthopedics 104:153-161

18 Ruf S, Baltromejus S, Pancherz H 2001 Effective condylar growth and chin position changes in activator treatment: a cephalometric roentgenographic study. Angle Orthodontist 71(1):4-11

19 McNamara JA 1981 Components of Class II malocclusion in children 8-10 years of age. Angle Orthodontist 51:177-202

20 Jacobsson SO 1967 Cephalometric evaluation of treatment effect on Class II, division 1 malocclusions. American Journal of Orthodontics 53:446-456

21 Ahlgren J, Lauris C 1976 Late results of activator treatment: a cephalometric study. British Journal of Orthodontics 3:181-187

22 Weislander L, Lagestrom L 1979 The effect of activator treatment on Class II malocclusions. American Journal of Orthodontics 75:20-26

23 McNamara JA, Bruden WL 2001 Orthodontics and dentofacial orthopedics. Needham Press, Ann Arbor, MI, 327

24 Proffit WJ, Fields HW, Ackerman JL, Sinclair PM, Thomas PM, Tulloch JFC 1993 Contemporary orthodontics. Mosby, St Louis, MO

25 GraberTM, Vanarsdall RL 1994 Current orthodontic principles and techniques, 2nd ed. Mosby, St Louis, MO, 437-506

26 Baiters W 1964 Die Technik und Ubung der allgemeinen und speziellen Bionator-therapie. Qintessenz, Berlin, Germany, and Hanover Park, IL

27 Ascher F 1968 Praktische Kieferorthopadie. Urban und Schwarzenberg, Miinchen-Berlin-Wien

28 Teuscher UM 1978 A growth-related concept for skeletal Class II treatment. American Journal of Orthodontics 74:258-275

29 Frankel R 1966 The theoretical concept underlying the treatment with functional correctors. Transactions of the European Orthodontic Society 1966:233-250

30 Frankel R 1969 The treatment of Class II division 1 malocclusion with functional correctors. American Journal of Orthodontics 55:265-275

31 Clark WJ 2002 Twin block functional therapy. Mosby, Edinburgh, 217

32 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh, 198-205

33 Scholey J, Melrose C,.Chadwick S 2003 The MBT system and the Twin Block appliance: the perfect combination? Orthodontic perspectives. 3M Unitek Orthodontic Products, Monrovia, CA

34 Pancherz H 1982 The mechanism of Class II correction in Herbst appliance treatment. American Journal of Orthodontics. 82:104-113

35 O'Brien K, Wright J, Conboy F, Sanjie YW, Mandall N, Chadwick S, et al 2003 Effectiveness of treatment for Class II malocclusion with the Herbst or Twin Block appliances: a randomized, controlled trial. American Journal of Orthodontics and Dentofacial Orthopedics 124:128-137

36 Read MJF, Deacon S, O'Brien K 2004 A prospective cohort study of a clip-on fixed functional appliance. American Journal of Orthodontics and Dentofacial Orthopedics 125:444-449

37 Tiirkkahraman H, Ozgur Sayin M 2006 Effects of activator and activator headgear treatment: comparison with untreated Class II subjects. European Journal of Orthodontics 28:27-34

CHAPTER 6

Fixed appliance selection

QUESTION

The MBT™ system using the .022 slot is the recommended fixed appliance. Why is this?

ANSWER

The MBT™ philosophy is a well-proven overall treatment system, and it works best in the .022 slot. The extra torque built into the incisors and molars exactly meets the needs of the case after a functional appliance. The reduced bracket tip helps anchorage control during leveling.

THE NEED FOR TOOTH CONTROL

A fixed-appliance system is necessary that has optimal tooth control, and can achieve the following:

1. The correction of any unwanted torque and tip that may have occurred during the functional appliance phase, particularly torque.
2. Ideal finishing, including a Class I occlusion and the condyles centered in the fossae.[1]

THE DEVELOPMENT OF THE MBT™ PHILOSOPHY

This well-established treatment system was developed by orthodontists for orthodontists. It has the advantages of being versatile, effective, tried and tested, easy to use, and it is globally recognized.

The background

During the 1970s and 1980s orthodontists were enthusiastic about preadjusted edgewise brackets, but continued to use traditional edgewise mechanics and force levels, and these did not work well with the new brackets. All kinds of unwanted changes were seen, such as loss of anchorage and the infamous 'rollercoaster effect.' As the specialty struggled to resolve these issues, attempts were made to correct the problems by introducing a wider range of Andrews' brackets with extra tip, torque and rotation control - the so-called 'extraction' or 'translation' series of brackets. Some of these were grouped together as the Roth appliance.

In the 1980s it became clear that light continuous forces with sliding mechanics worked well with unmodified SWA brackets, so that the extra features of 'extraction' series or 'Roth' series were not required. In fact, modified brackets were a disadvantage when using ideal sliding mechanics and light forces. For example, the tip of 13 or even 15 degrees in the upper canine brackets (compared with the 8 degree research findings) actually added to the problems. The extra canine tip required more anchorage, and tended to produce results with the canine and premolar roots too close together.

The development of the mechanics

The way forwards became clear. It was necessary to perfect the mechanics and then go back and redesign the brackets.

Therefore, through the 1980s, the treatment mechanics were refined, and published in a series of papers.[2-4] Mainly basic SWA brackets were used, and it was found that they had shortcomings. These derived from the extra tip (over and above the research findings), which had been designed into the original SWA, and from the poor ability of the edgewise bracket to deliver torque control.

By the early 1990s good treatment mechanics had been refined, and, with the help of 3M Unitek, it was time to create a whole new bracket system ideally suited to the mechanics. The all-new bracket system was released at the American Association of Orthodontists meeting in Philadelphia in May 1997 as MBT™.

An overall philosophy

The brackets are only part of the story. From the outset the aim was to develop an overall treatment philosophy to be used worldwide. As well as high-quality brackets there was a need for optimal bracket positioning, ideal force levels and proper arch forms. All this was encapsulated in the textbook 'Systemized Orthodontic Treatment Mechanics',[5] which was published in 2001 and is now available in twelve languages. In computer terms, if the brackets are considered to be the 'hardware' then the book contains the all-important 'operating system and software' (Fig. 6.1).

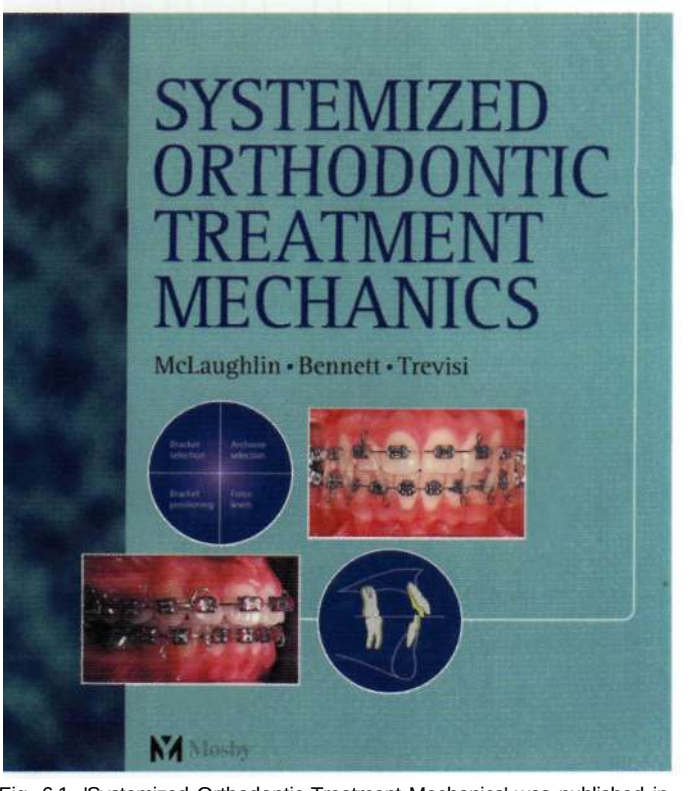


Fig. 6.1 'Systemized Orthodontic Treatment Mechanics' was published in 2001 and is often referred to as 'Book 3.'

Since its release in 1997 the MBT™ philosophy has seen acceptance as the only fully documented and well-proven treatment system for the preadjusted appliance. It is increasingly the logical choice for orthodontists, and is now fully recognized as a reliable, well-tried and versatile global solution. It has features and bracket specifications that are uniquely suited to achieving dental correction in most cases after functional appliances (Figs 6.2 & 6.3).

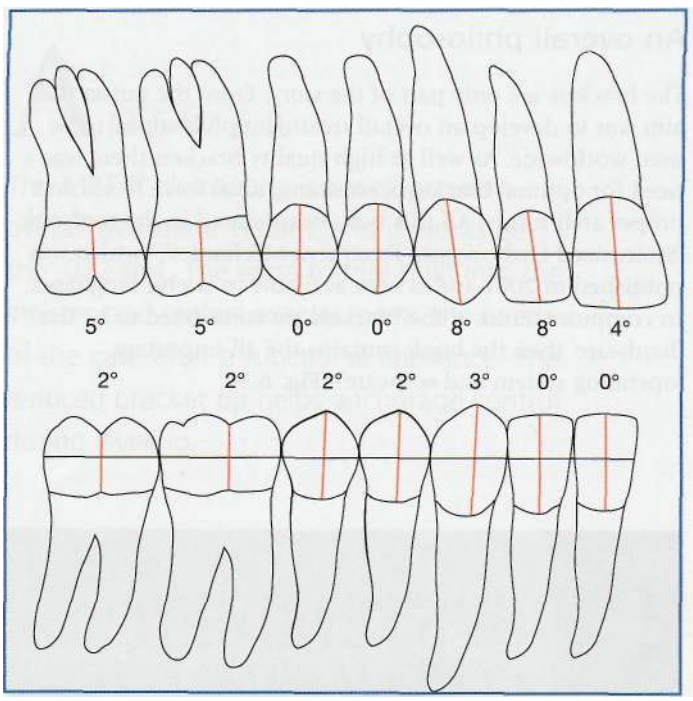


Fig. 6.2 The tip specifications of MBT™ brackets.

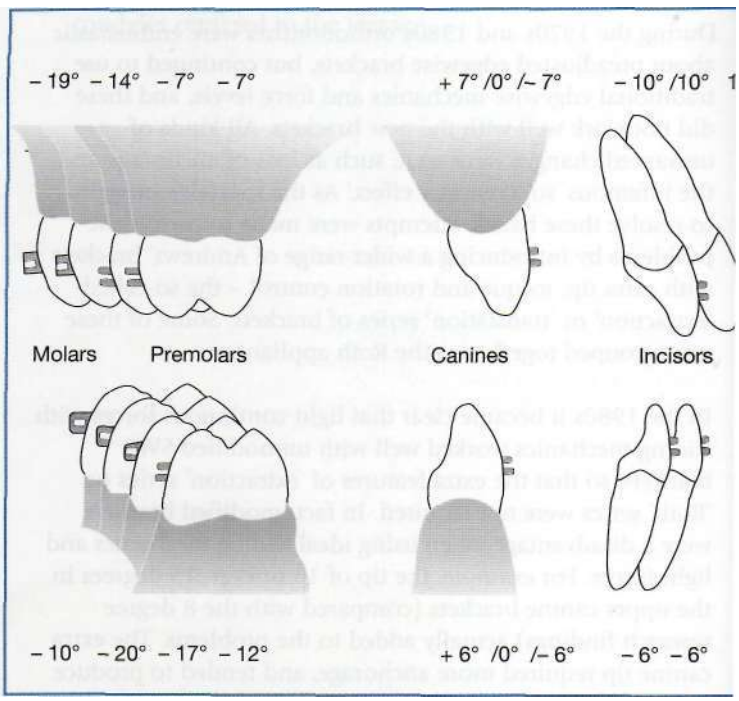


Fig. 6.3 The torque specifications of MBT™ brackets.

TOOTH CONTROL WITH DIFFERENT BRACKET TYPES

The MBT™ system is available in a variety of bracket choices, but conventional full-size or mid-size metal brackets are recommended after the Andresen appliance because of the need for optimal tooth control.

Bracket performance is the priority for finishing these selected uncrowded cases, and therefore self-ligating or clear brackets are not the preferred choice. Reduced friction or enhanced appearance are not the main requirements, and such brackets tend to have increased bulk, with an increased distance from the slot base to the enamel surface. This can lead to reduced tooth control and a more difficult finishing stage, especially in cases with incisor rotations.

Full-size metal brackets

The need for metal brackets was explained at the outset (page 44), and children in the age group 11 years to 13 years will normally agree to having metal. Almost all the girls will ask *for colored modules (Fig. 6.4), and most youngsters are not* concerned with any difference in size between full- and mid-size metal brackets.

The full-size metal brackets were developed in Miinchen and these are an ideal choice for the fixed-appliance phase, because of their precise build specifications and their unrivalled tooth control. Lower second premolar tubes have resistance to bond failure and reduced occlusal interference compared to normal brackets, and are preferred for most cases. Mid-size first premolar metal brackets are often used in combination with full-size metal brackets elsewhere in the case set up. Mid-size canine brackets and full-size canine brackets are of similar size and performance - it is among the incisors that the specifications and the unrivalled tooth control from the full-size bracket is so important.

Mid-size metal brackets

Many orthodontists use mid-size brackets routinely, and they are entirely suitable for use after functional appliance wear. They have advantages for individuals with small teeth, or *where oral hygiene is a concern, but there may be a need for* more care with detailing in the closing stages, due to slightly reduced tooth control compared with full-size brackets.

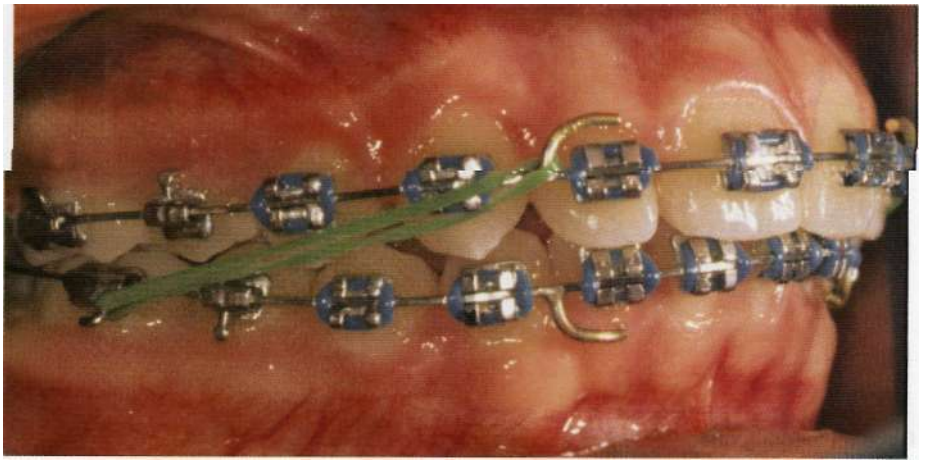


Fig. 6.4 Metal brackets are generally well accepted by children in the age group 11-13 years, and almost all the. girls will. ask. for colored modules.. Most youngsters are not concerned with any difference in size between full-size (seen here and on all the cases in this book) and the smaller mid-size metal brackets.

THE CORRECTION OF TORQUE AFTER FUNCTIONAL APPLIANCES

As discussed in Chapter 5, all functional appliances retract teeth in the upper arch, using the lower arch as anchorage. Therefore, the Andresen and other functional appliances achieve overjet correction by retroclination of the upper incisors and/or proclination of the lower incisors, resulting in the same well-documented incisor torque changes during overjet correction, and upper molar torque changes during expansion. The MBT™ bracket system was designed with additional torque control built into the required areas - the upper and lower incisor regions and the upper molars (Fig. 6.5).

The MBT™ torque specification meets the needs of the cases, and thus the bracket system is uniquely suited to correct incisor and molar torque after functional appliance treatment (Figs 6.6 & 6.7).

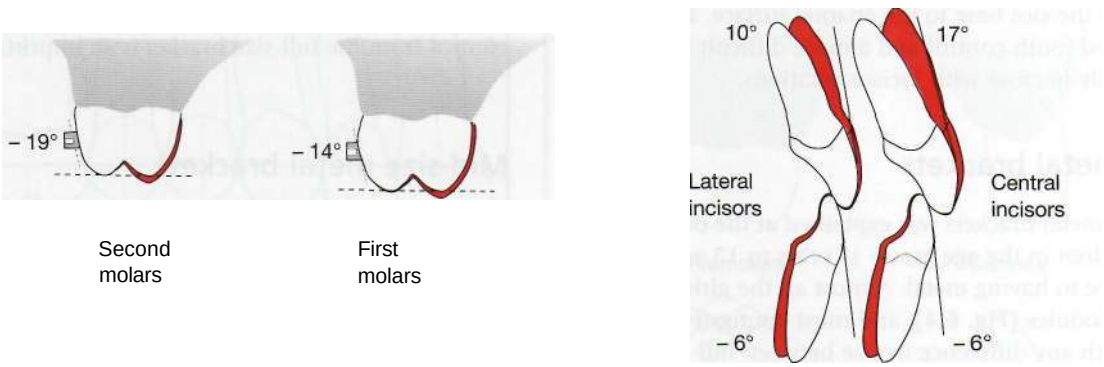


Fig. 6.5 After treatment with a functional appliance torque correction is often required in the incisor and molar regions. The MBT™ bracket system was designed with additional torque control built into the required areas.

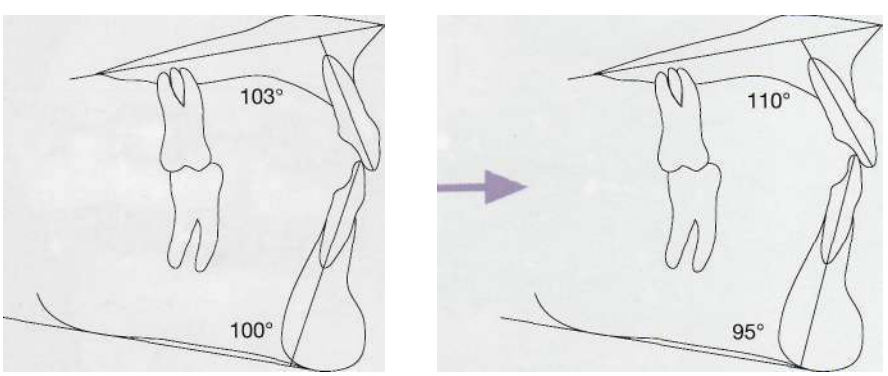


Fig. 6.6 Incisor torque correction is frequently needed after functional appliances.

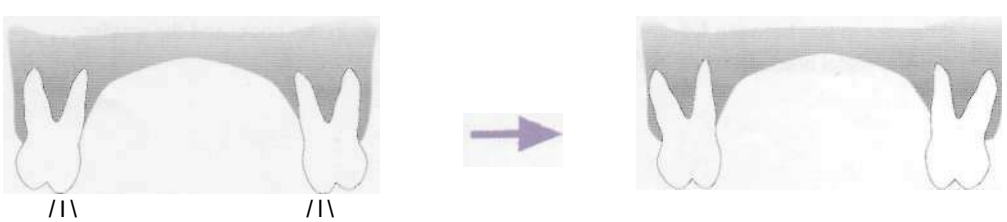


Fig. 6.7 Molar torque correction prevents interferences from the palatal cusps of molars.

THE CORRECTION OF TIP AFTER FUNCTIONAL APPLIANCES

Management of tip during the fixed-appliance phase is easier than torque control and correction, and is fully discussed in Chapter 8 (page 128). There is less threat to anchorage than existed with the original SWA, and therefore not as much risk of overjet relapse during the early months of the fixed appliance stage, because the MBT™ bracket system has less tip than SWA (Fig. 6.8).

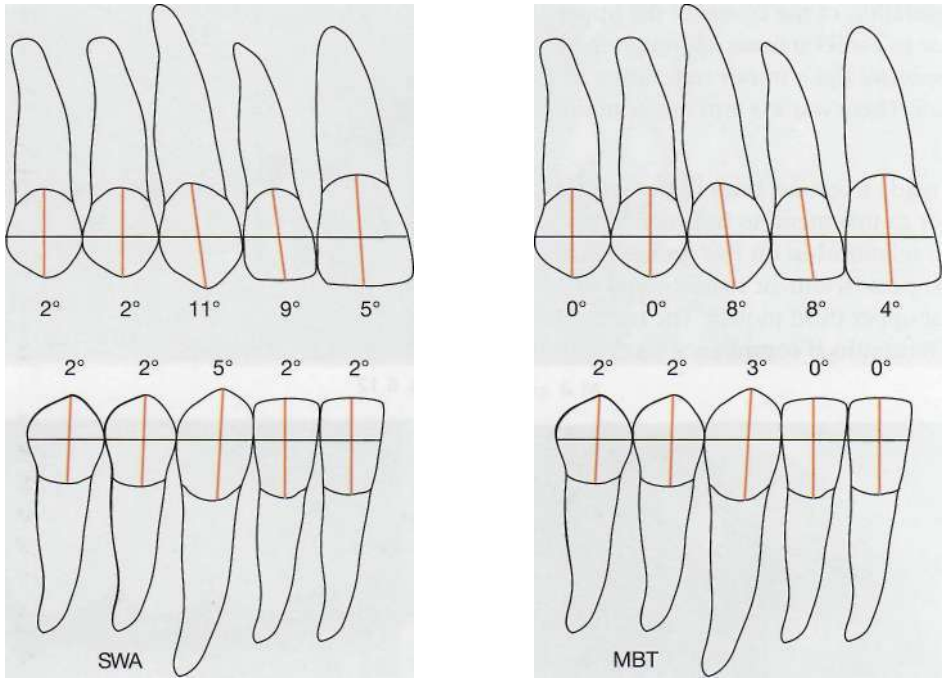


Fig. 6.8 The MBT™ bracket system has less tip than the original SWA, and so there is less threat to anchorage and reduced risk of overjet relapse during the early months of the fixed-appliance stage.

CASE AR

This Irish girl was aged 11 years 9 months and presented with a Class II division 1 malocclusion on an average angle pattern, with MM angle of 28 degrees. There was a history of thumb sucking, which had recently ceased. The A/P skeletal pattern was Class II with an ANB of 5 degrees and a Wits of + 5 mm. The family home was 200 miles from London.

Dentally, the patient had an overjet of 11.0 mm (Figs 6.12, 6.13, & 6.14), a bilateral Class II molar occlusion and minimal upper and lower incisor crowding (Figs 6.16 & 6.17). There was discoloration of the crown of the upper right central incisor due to earlier trauma, although the tooth gave a normal vital response, and a minor restoration of the upper left central incisor. There was a 3 mm upper midline shift to the right.

The rare decision was made to extract both upper second permanent molars prior to treatment, to facilitate full correction of the molar relationship on this average-angle female patient, to assist post-treatment stability, and to allow unimpeded eruption of upper third molars. The treatment was projected to last 18 months if compliance was good.

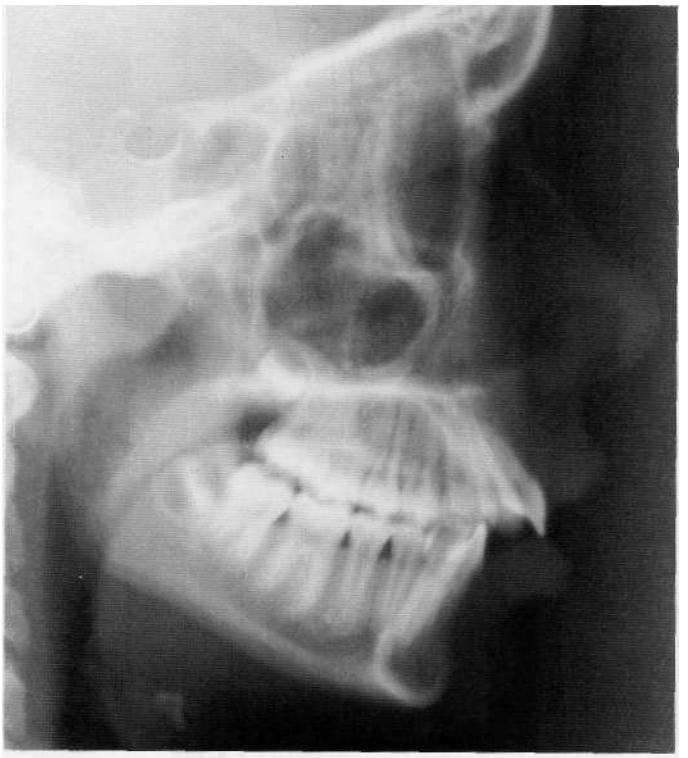


Fig. 6.18

Fig. 6.9

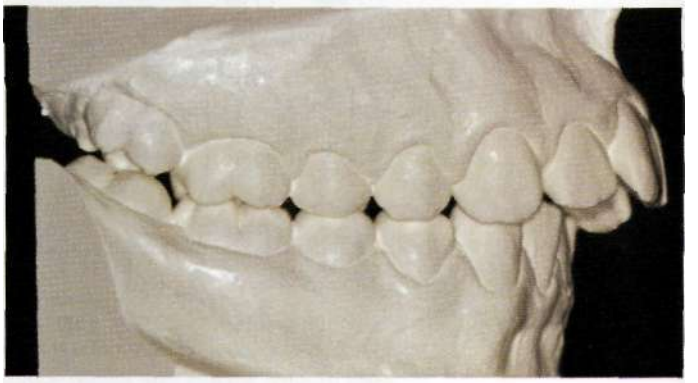


Fig. 6.12

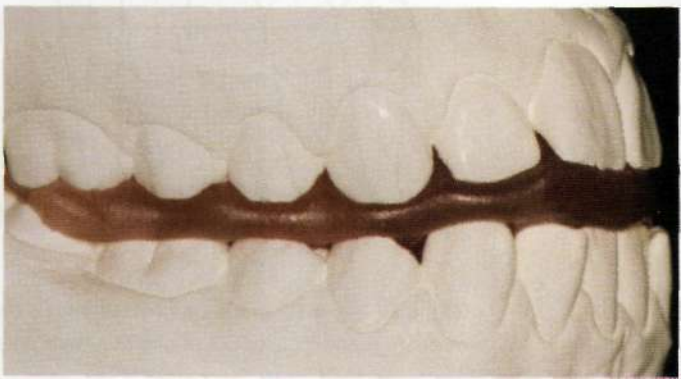


Fig. 6.15

The first Andresen appliance was constructed using a wax bite with the mandible protruded approximately 7 mm and it was fitted at age 11.10 years. After 4 months of good compliance, a second appliance was made using a wax bite with the mandible protruded to an edge-to-edge incisor relationship (Fig. 6.15) and this was used for a further 3 months to fully reduce the overjet.

Fig. 6.10

Fig. 6.11

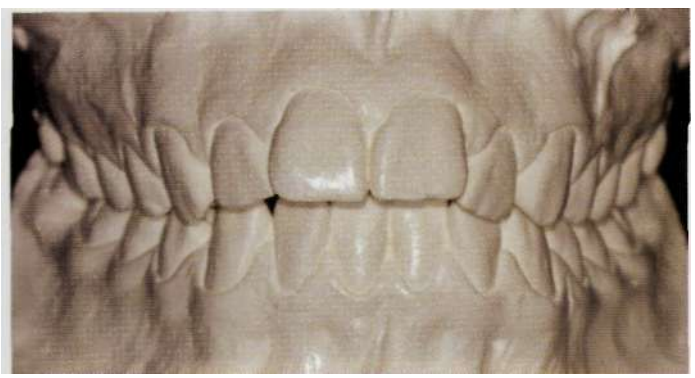


Fig. 6.13

Fig. 6.14

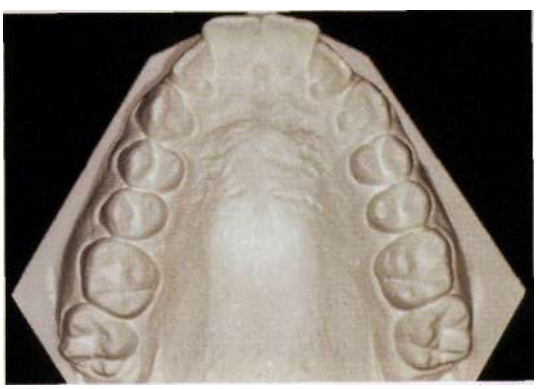


Fig. 6.16

Fig. 6.17

Case OD age 11 .9

SNA	81°
SNB	76°
ANB	5°
Wits	+ 5 mm
MM	28°
U1 to Max plane	114°
L1 to Mand plane	89°

Fig. 6.19

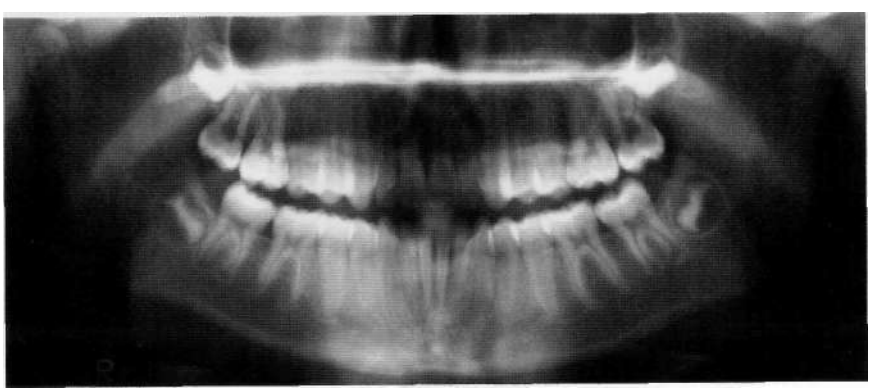
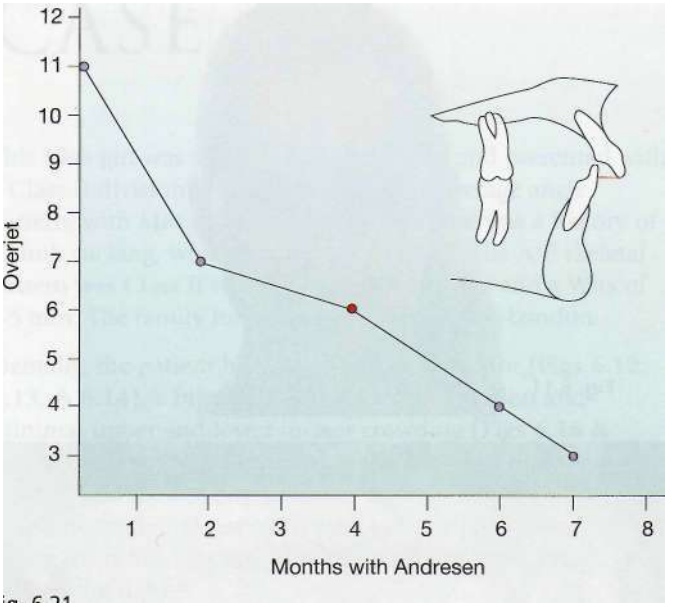


Fig. 6.20



The overjet was reduced to 3 mm using Andresen appliances for 7 months (Figs 6.21 to 6.26). Figure 6.27 shows the second Andresen appliance in the mouth. The rapid overjet reduction may have occurred partly in response to the recent cessation of thumb sucking. Full-size metal upper and lower fixed appliances were placed at agel2.5 years, without a pause.

The opening archwires were .016 round HANT (heat activated nickel titanium)and these were replaced by upper and lower .019/.025 rectangular HANT wires at the first adjustment visit at age 12.7 years (Figs 6.28 to 6.30, 6.32, & 6.33). The upper right canine bracket and the upper left central incisor brackets were repositioned at this visit. Good alignment of the lower labial segment was achieved after 8 weeks, using full-size metal brackets and HANT wires.

Lower second molars were included in the set up to assist in maintaining overbite control, and to prevent vertical discrepancies in response to the light Class II elastics (70 Gm), which were being worn during sleeping hours to Kobayashi hooks on the upper canine brackets (Fig. 6.31). The patient was seen infrequently due to the traveling distance for each visit, but showed first-class cooperation.

Fig. 6.22

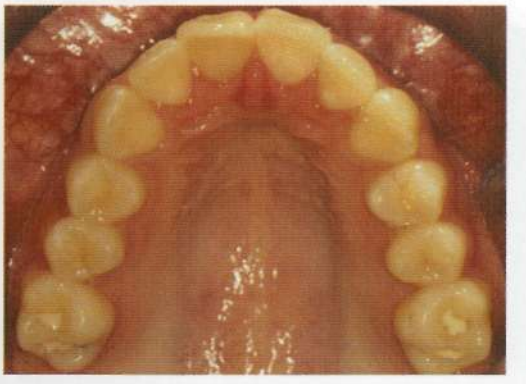


Fig. 6.25

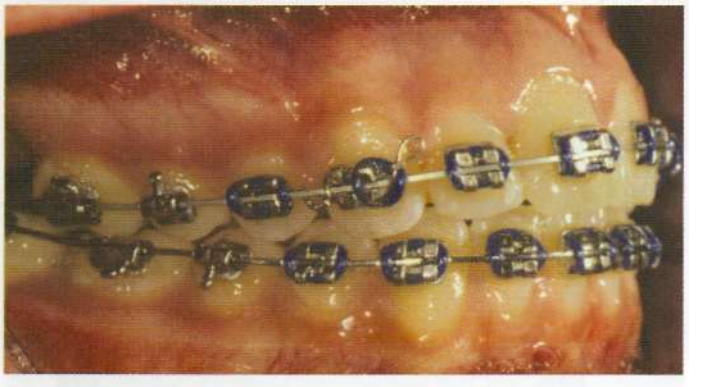


Fig. 6.28

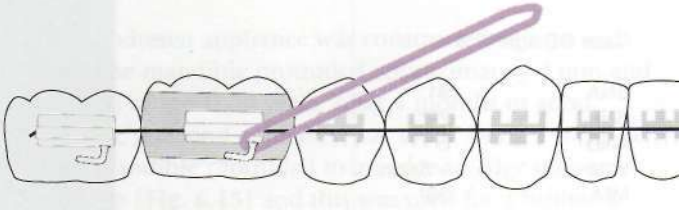


Fig. 6.31

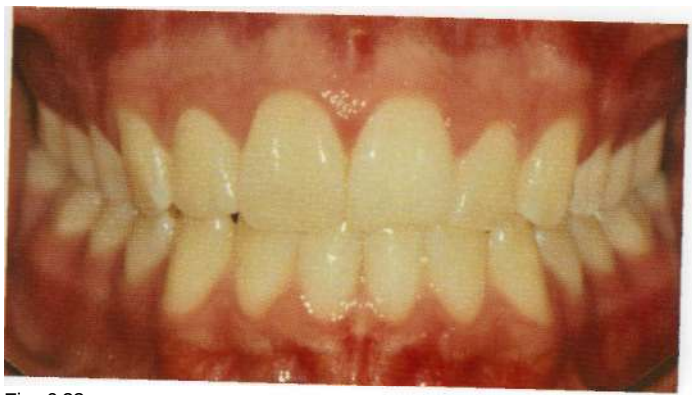


Fig. 6.23

Fig. 6.24

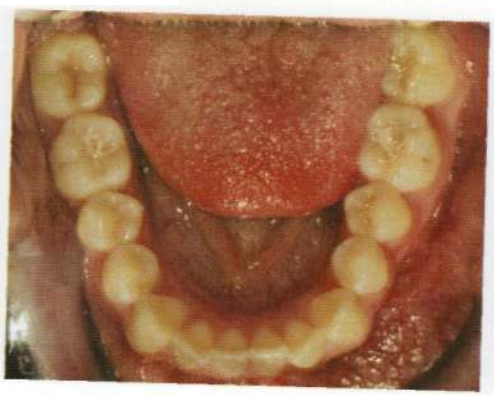


Fig. 6.26

Fig. 6.27

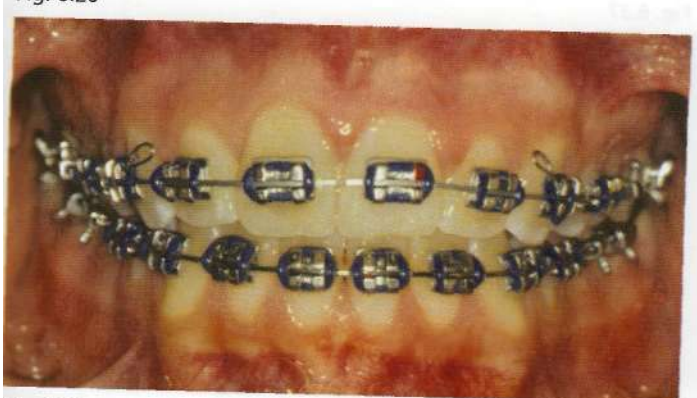


Fig. 6.29

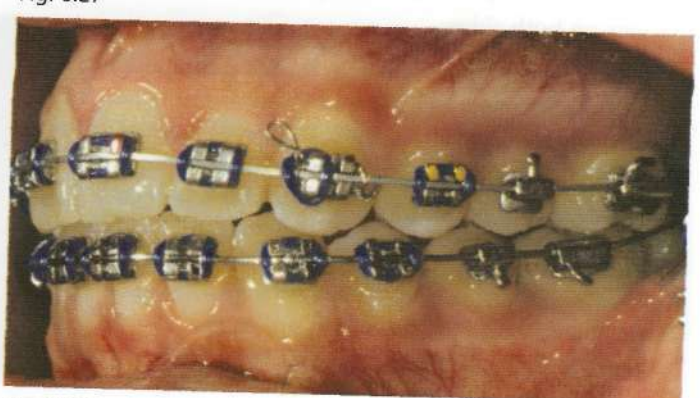


Fig. 6.30

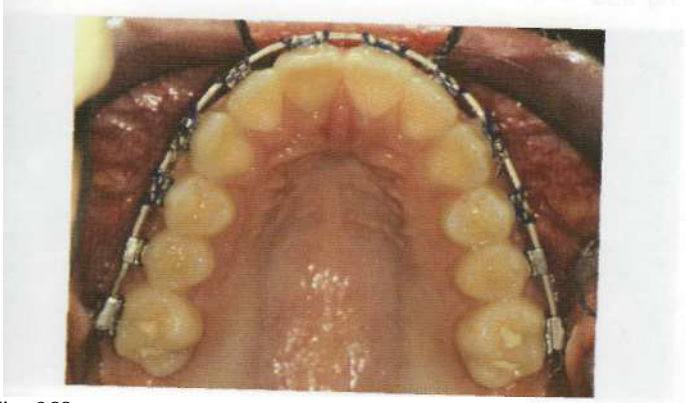


Fig. 6.32

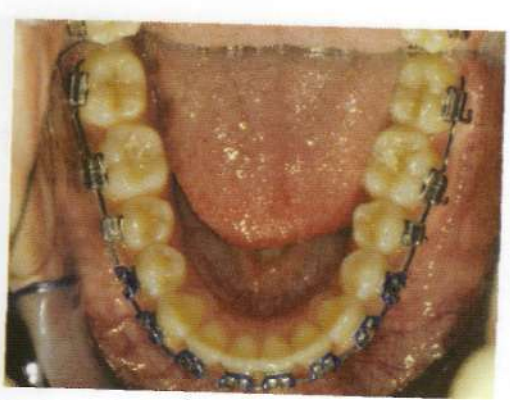


Fig. 6.33

At age 12.9 years a normal upper rectangular steel .019/.025 working wire was placed (Figs 6.34 to 6.36). Sleeping Class II elastics continued on the left side to assist in correction of the midline discrepancy and to achieve a Class I molar relationship on the left side, which had been more difficult at the outset. Two lower brackets were repositioned and the lower rectangular HANT wire therefore remained in the lower arch. In this case HANT wire was sufficient to maintain overbite control ('Systemized Orthodontic Treatment Mechanics',[5] page 111) because there was not a difficult overbite problem at the start with the MM angle being 28 degrees and the overbite incomplete.

Rough study models were taken (Figs 6.37 & 6.38) to check tooth alignment needs during the remaining part of the treatment. Models of this type can be quickly taken and often reveal treatment needs that cannot be detected visually in the mouth.

At age 12.11 there was a small skid at terminal closure (Chapter 8, page 133) and the patient was asked to wear left and right Class II elastics (80 Gm) during the evenings and at night to correct this. The upper arch wire had swiveled with the potential to cause soreness to the cheek (Fig. 6.39). This could have been avoided if the passive tiebacks had been more carefully placed, ensuring that the brass hooks were positioned midway between the canine and lateral incisor brackets on both sides.

There had been a rapid change in profile during the first 12 months of treatment and the lower lip was rather pendulous and unaesthetic in relation to the improved incisor position (Fig. 6.42). This temporary appearance is often seen and can be exaggerated due to the effect of the brackets (Figs 6.41 & 6.43). Patient and parents can be reassured that a pleasing appearance is normally achieved after removal of the fixed appliances and a year or two of normal growth and development, while the lips 'catch up.' At age 13.2 years the case was close to completion (Figs 6.44, 6.45, & 6.46).

Fig. 6.34

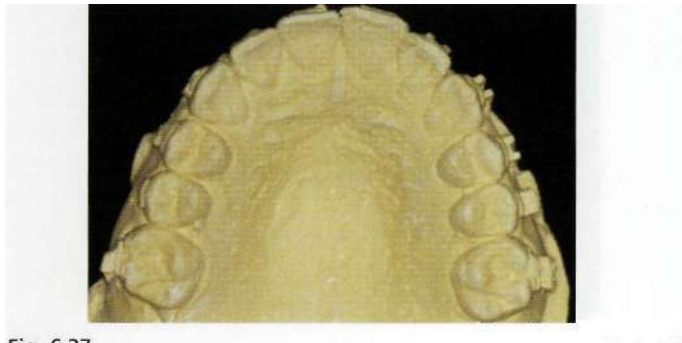


Fig. 6.37

Fig. 6.38

Fig. 6.44

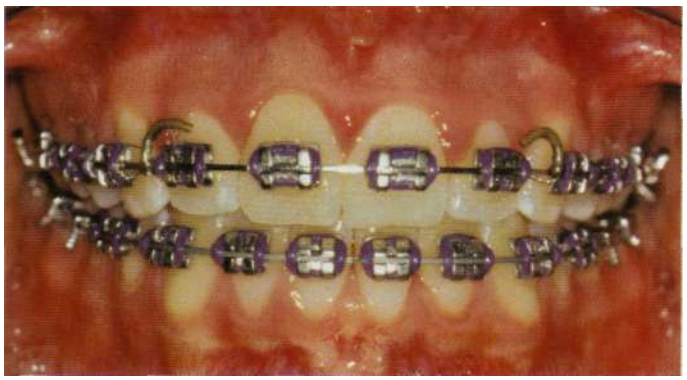


Fig. 6.35

Fig. 6.36

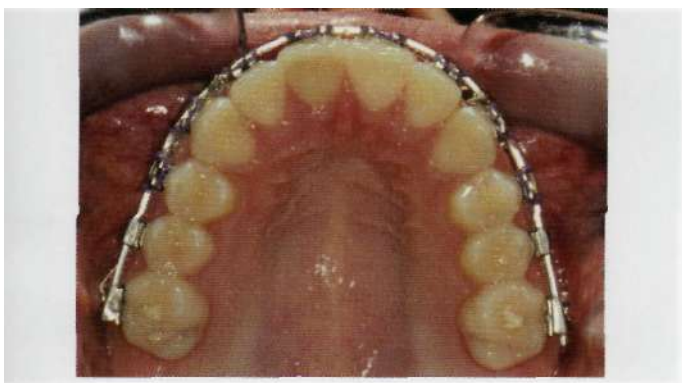


Fig. 6.39

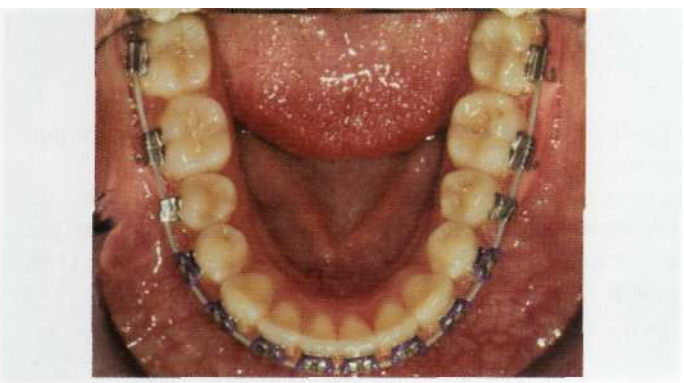


Fig. 6.40

Fig. 6.41

Fig. 6.42

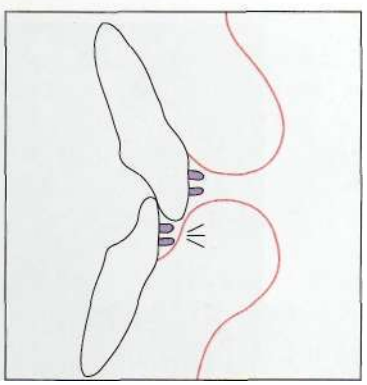


Fig. 6.43

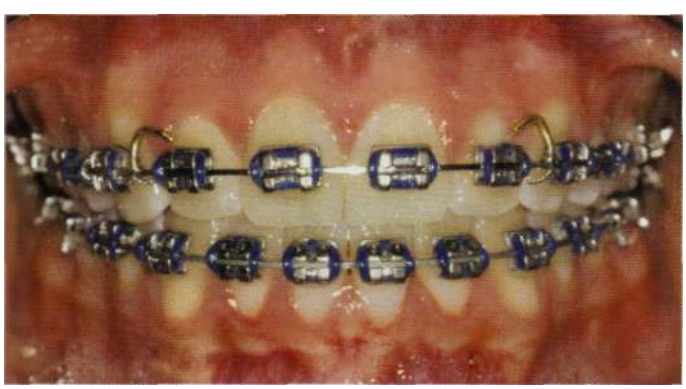


Fig. 6.45

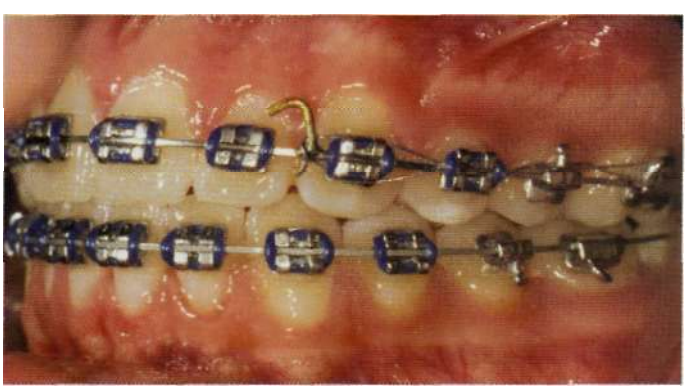


Fig. 6.46

After appliance removal at age 13.3 years the patient had a pleasing profile, and although the lips were slightly apart at rest (Fig. 6.47), it was possible to obtain a lip seal without muscular effort (Fig. 6.48). The pleasing three-quarter view (Fig. 6.53) is more typical of social contact than the profile view.

A tooth positioner was used for 2 months before proceeding into normal retention at age 13.5 years, using an upper vacuum formed removable retainer and a lower canine-to-canine bonded retainer. On the panoramic radiograph the previously injured upper right central incisor root is seen to be rather opaque, and the upper third molars appear to be moving mesially towards a good eruptive position. The final radiographs were taken just before removal of the fixed appliances (Figs 6.56 & 6.58).

Cephalometrically it was possible to achieve incisor torque measurements that were close to ideal, as the case maintained the average vertical pattern and showed an improved Class I A/P skeletal pattern. The final radiographs were taken just before removal of the fixed appliances (Figs 6.56 & 6.58.

Fig. 6.47

Fig. 6.50

Fig. 6.53

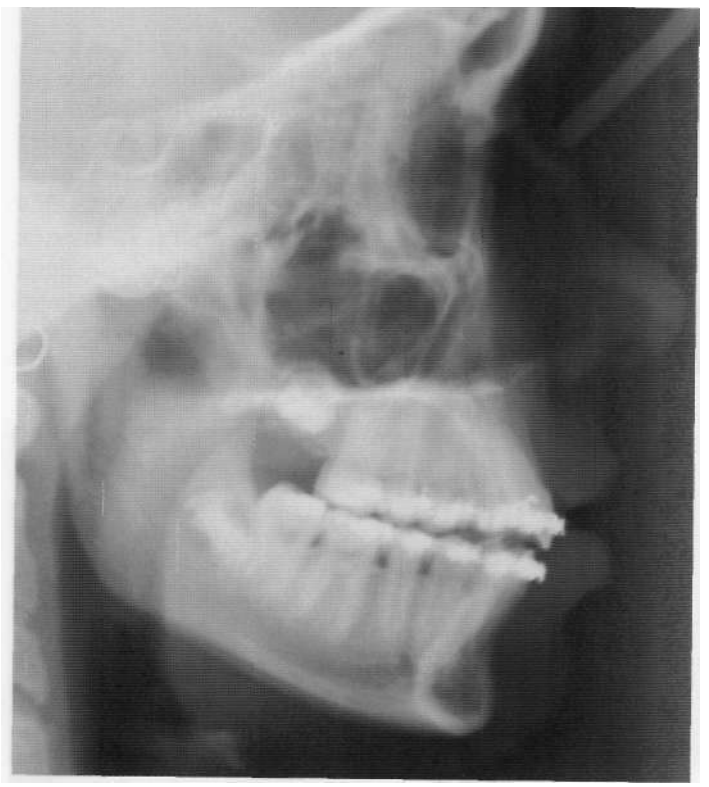


Fig. 6.56

Case AR age 13.3

SNA	82°
SNB	78°
ANB	4°
Wits	-1 mm
MM	28°
U1 to Max plane	116°
L1 to Mand plane	98°

Fig. 6.57


Fig. 6.48


Fig. 6.49


Fig. 6.51


Fig. 6.52

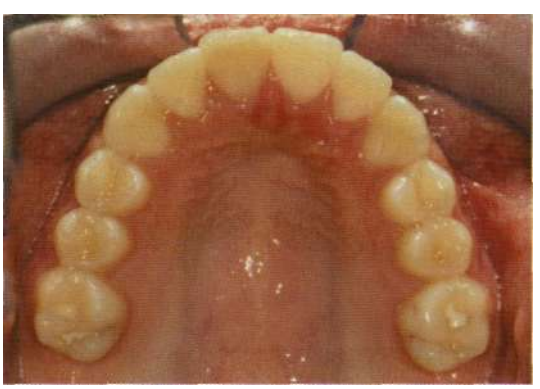


Fig. 6.54

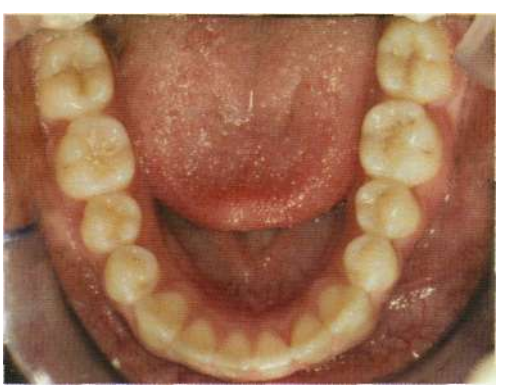


Fig. 6.55

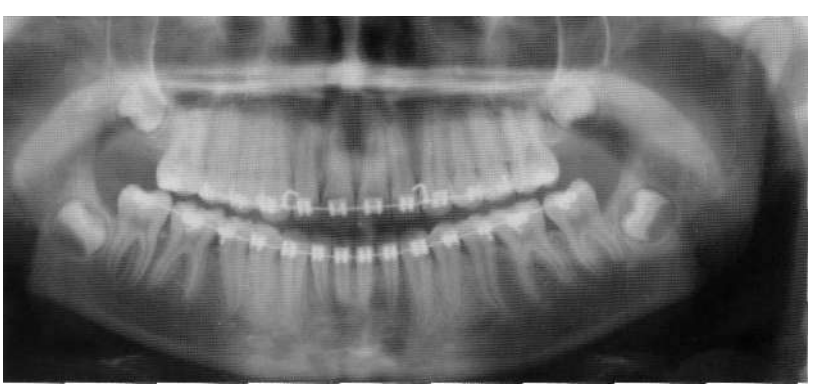
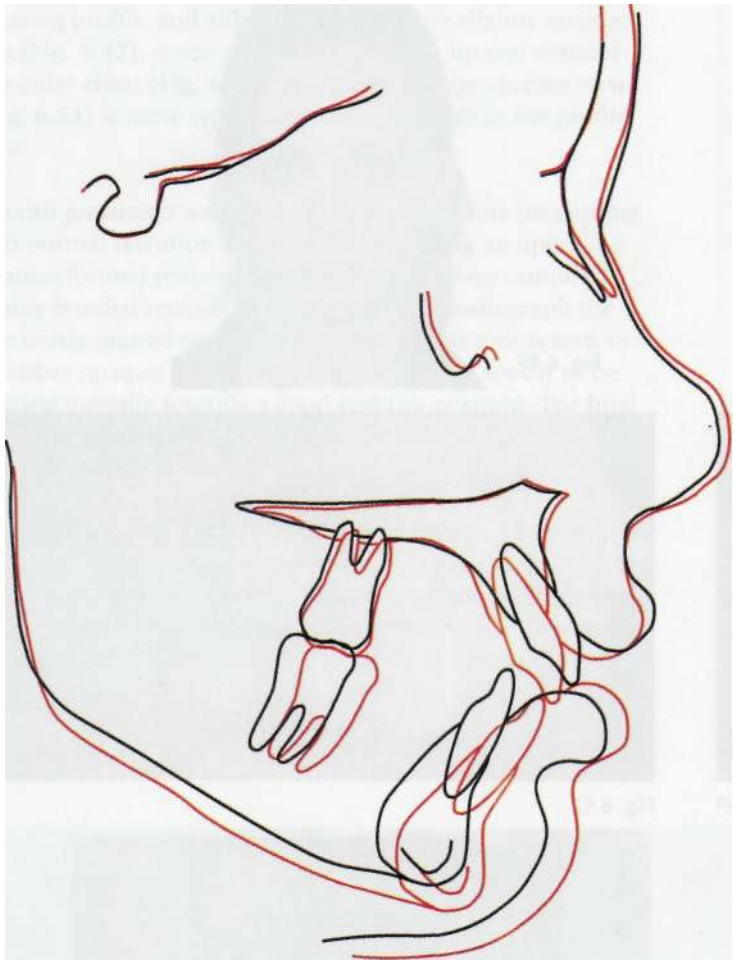


Fig. 6.58



Case AR	age 11.9	age 13.3
SNA	81°	82°
SNB	76°	78°
ANB	5°	4°
Wits	+ 5mm	- 1 mm
MM	28°	28°
U1 to Max plane	114°	116°
L1 to Mand plane	89°	98°

Fig. 6.59 The Case AR before and after tracings are shown at 80% of actual size, and are superimposed on sella-nasion line at sella. The treatment lasted 18 months and moderate downward and forward growth occurred. The upper lip was short at the start of treatment and remains so, but the patient is able to achieve a lip seal and the corrected incisor relationship provides an environment for normal lip function and development. A little more lingual crown torque could have been beneficial in the lower incisor region. The upper second molars were extracted to assist the treatment mechanics in this case, as there is evidence that this can help to achieve molar correction and also reduce treatment time.[6] During treatment it proved possible to fully correct the Class II molar relationship. It was anticipated that this average angle female patient would show less favorable growth than low angle male patients (pages 80 and 142) and the superimpositions tend to support this view.

REFERENCES

1 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh, Chapter 10, 279-303

2 McLaughlin RP, Bennett JC 1989 The transition from standard edgewise to preadjusted appliance systems. Journal of Clinical Orthodontics 23:142-153

3 Bennett JC, McLaughlin RP 1990 Controlled space closure with a preadjusted appliance system. Journal of Clinical Orthodontics 24:251-260

4 McLaughlin RP, Bennett JC 1991 Finishing and detailing with a preadjusted appliance system. Journal of Clinical Orthodontics 25:251-264

5 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh

6 Waters D, Harris EF 2001 Cephalometric comparison of maxillary second molar extraction and nonextraction treatments in patients with Class II malocclusions. American Journal of Orthodontics and Dentofacial Orthopedics 120:608-613

CHAPTER 7

Managing the Andresen appliance

QUESTION

U E ST IO N

What is essential for success with the Andresen appliance?

ANSWER

The appointment for impressions and wax bite needs to be tranquil and unhurried and so do the subsequent visits for fitting and adjusting the appliance. The wax bite is all-important, ensuring midlines are respected and excessive protrusion avoided. The technician needs to be experienced and caring, and the appliance has to be comfortable. If the starting overjet is 8 mm or more, two successive Andresens will normally be needed.

Each orthodontic practice or clinic will organize treatments differently, and will have its own priorities for appointments and other aspects of case management, but some general comments can be made.

Treatment success begins at the time of receiving the first phone call. A caring and helpful telephone manner sets the tone for the later treatment, and begins to establish a friendly and professional relationship. Some patient details need to .be recorded,[1] and it is helpful to explain the procedures that may be needed at the first visit, with reassurance that these are normally not unpleasant or painful.

APPOINTMENTS

Time management is important in today's world. Patients and their parents need to attend in order to receive the orthodontic service, but most will appreciate efficient use of appointment time. They will be grateful if as much as possible is achieved at each visit, and the number of visits is limited. Therefore, it helps if plenty of time is allowed for the first appointment, to permit full discussion, but also to take records if appropriate.

The first appointment

If the case appears suitable for functional/fixed treatment, this can be mentioned at the first appointment, without going into too much detail, and examples of appliances can be shown. It is helpful to indicate probable timing, for example: 'You should be ready to start within 12 months' or 'Your dentition is sufficiently mature to start very soon.' Where appropriate orthodontic records can be taken and a second appointment scheduled to discuss and confirm the treatment needs (Chapter 4, pages 43-45) explaining the details of the functional/fixed method. The patient and parents should be aware of what will probably happen at the second visit: 'We will mainly be talking, and possibly we will need to take new impressions and a wax bite, to construct the first appliance.'

The younger patient

If the patient is Class II division 1, but clearly too young, it is helpful to explain the reasons for advising a delay, by quoting material from Chapter 2 (page 13): 'If we start too early, you will have a longer treatment experience and there is no evidence that the outcome will be any better.' It can be confirmed that it is necessary to see the children when young, to avoid the feeling of a wasted visit.

If a recommendation is made to delay starting treatment, it is necessary to. inform the patient and parents of the risk of enamel damage, which has been shown with increased overjets (page 17). During this first visit the orthodontist will have formed an opinion about the child's attitude to life, such as 'shy and withdrawn' or 'easy going and robust,' and a private word with the parents is appropriate, to enquire about issues with teasing or lack of confidence (page 17).

The second appointment

Again, plenty time should be set aside for this. It is necessary to fully explain the proposed treatment, as described in Chapter 4 (page 42), because this is the foundation for good cooperation later on.

If the family decide to go ahead, and the dentition is sufficiently mature, new impressions and a protrusive wax bite will need to be taken at the second appointment, so that treatment can be started at the third visit. It is essential to maintain an air of tranquility for taking the wax bite (page 103), with no distractions, and it helps if the parents will agree to the child being seen by just the orthodontist and an assistant for this.

The impressions for the Andresen

High-quality impressions are needed and perforated Coe trays or similar are preferred, with some soft wax build-up in the lower molar lingual sulcus (Fig. 7.1). The alginate mix should not be too liquid, as firmer material carries better into the important lingual sulcus area. After placing the lower tray partly into position, the patient should be asked to, 'Please put your tongue over the top,' with a gesture from the orthodontist, so that they gently protrude the tongue. On the instruction, 'Now relax your tongue,' the tongue drops back to a relaxed position and then the tray may be fully seated to ensure a good impression in the important lower lingual sulcus area (Fig. 7.2). The upper impression should include the full labial sulcus in the upper canine regions, where the technician will place the loops in the labial bow.

Fig. 7.1 Perforated Coe trays or similar are preferred, with some soft wax build-up in the lower molar lingual sulcus.

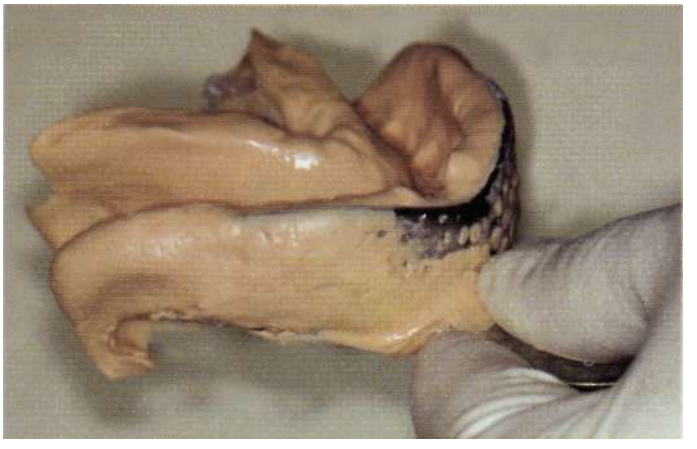


Fig. 7.2 It is important to ensure a good alginate impression in the lower lingual sulcus area.

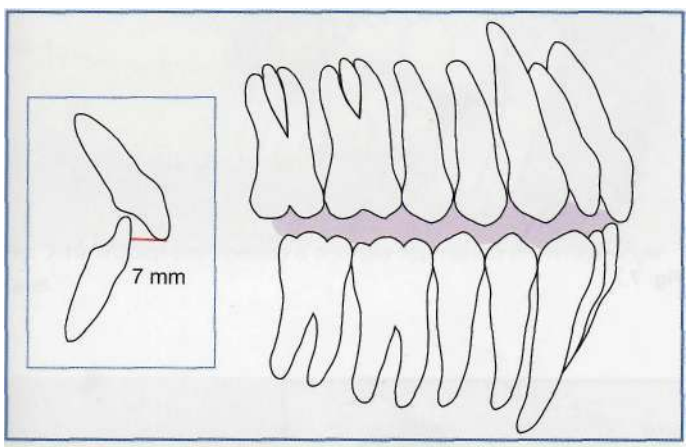
THE WAX BITE

Before taking the wax bite, the study models can be used to help to decide if the overjet can be corrected with one Andresen or whether a second one will be needed (case TE, page 22). If the overjet is 8 mm or more two will normally be required (Figs 7.3 & 7.4). Midlines should be respected (Fig. 7.5). For example, a lower midline which is 2 mm to the left at centric occlusion, should be 2 mm to the left at protrusive wax bite.

The wax bite needs to be taken in a calm, unhurried manner. An atmosphere of tranquility should be established, quietly talking to the child and with only the orthodontist and assistant present, preferably.

'This is a wax bite, like the one before. Please relax, and let your shoulders go loose. For this wax bite we need your lower jaw a little forward. Let's just practice together.' A short practice session helps, with murmured words of encouragement from the orthodontist, before using any wax.

Fig. 7.5 Any midline discrepancy should be respected when taking a wax bite. In this case there was no discrepancy.



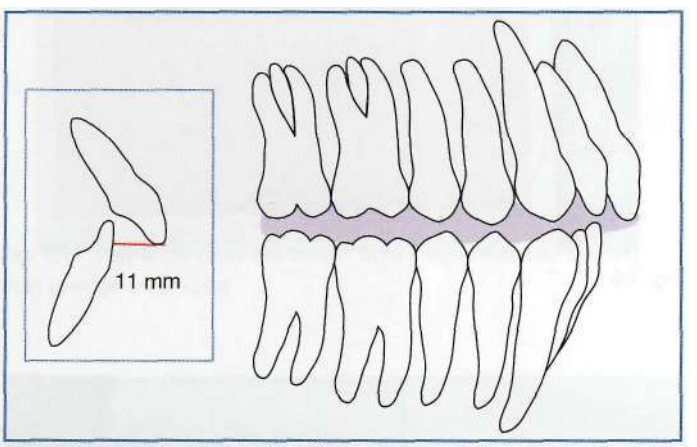


Fig. 7.3 If the overjet is less than 8 mm it can normally be corrected with one Andresen appliance. For these cases the wax bite can be taken with the mandible protruded sufficiently to bring the incisors almost edge-to-edge.

A piece of good quality pink wax of approximate 6 x 8 cm dimensions is warmed in hot water and folded over two or three times to make a soft sausage of wax (Figs 7.6 & 7.7). A slightly more bulky sausage will be needed for deep-bite, low-angle cases.

The softened wax is pressed onto the upper teeth and then the lower jaw protruded, as in rehearsal: 'Good ... slowly bring your lower jaw forwards ... a little more ... slowly, close a little ... stop. That's it.' The wax bite is then cooled and, if necessary, trimmed with a sharp knife. It should be carefully checked in the mouth and on the models if possible (Fig. 7.8). The indentations from the lower teeth should be only 2 or 3 mm deep (Fig. 7.9). Most children will manage a good wax bite at the first attempt after a short practice session, but sometimes a second or third attempt is needed, Accuracy is essential,

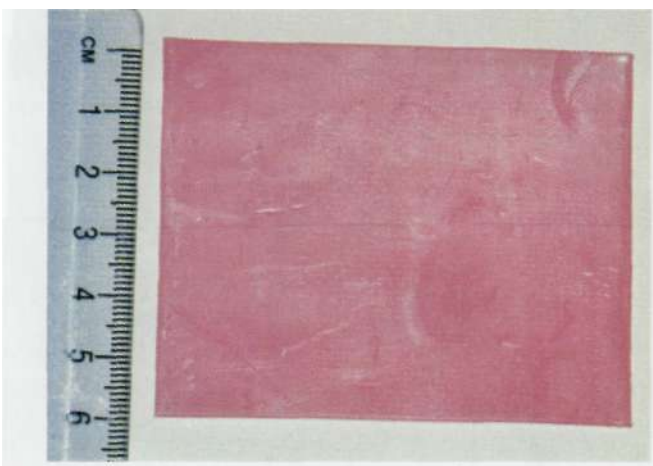


Fig. 7.6

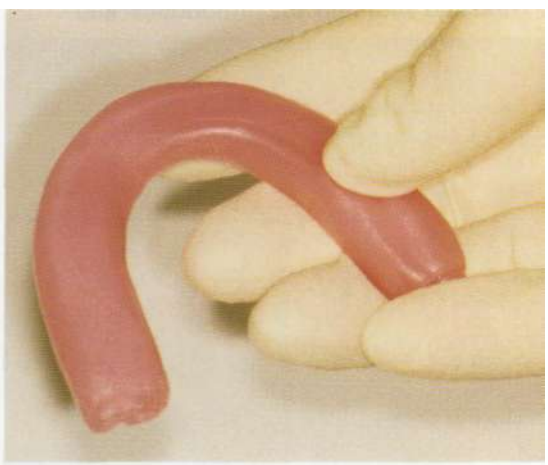


Fig. 7.7

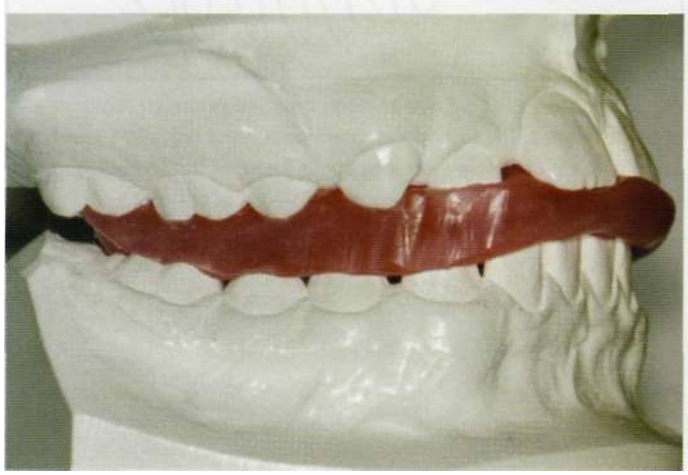


Fig. 7.8 The wax bite should be carefully checked in the mouth and on the models if possible. It can be helpful if it is trimmed with a sharp knife to show the buccal relationship and to avoid impingement in the soft tissue of the tuberosity area.

Fig. 7.9 The indentations in the wax bite from the lower teeth should be only 2 or 3 mm deep,

Opening and protrusion for the wax bite

The correct amount of bite opening and protrusion is much discussed in the literature. The decision varies, according to the needs of the case. Normally 2-4 mm of opening at the incisor region is sufficient, but low-angle cases will benefit from a little more opening than average-angle cases (Figs 7.10 & 7.11).

The wax-bite protrusion should not be excessive, as this makes the appliance difficult to wear, and can reduce compliance. The aim is to unload the condyles, and often a small amount of protrusion (5 or 6 mm) will be appropriate. Up to 7 or 8 mm of protrusion is normally well accepted by the patient, but if the overjet is 9 mm or more, a second Andresen appliance will normally be the preferred option, with the first one being protruded only about 6 mm (Fig. 7.12). The case reports include comments on wax-bite construction, showing how it varies according to the needs of the case.

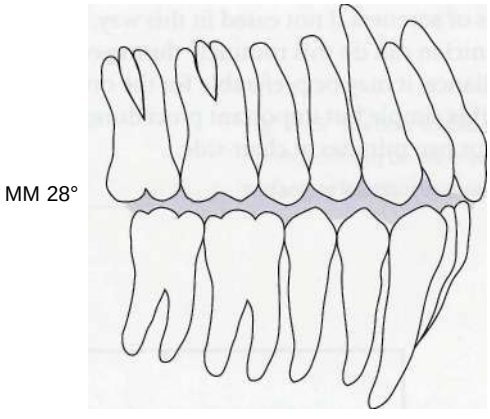


Fig. 7.10 Modest bite opening is normally appropriate in average-angle cases.

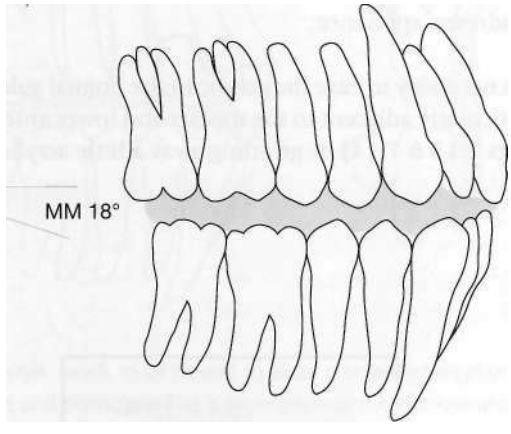


Fig. 7.11 Low-angle cases will benefit from a little more bite opening than average-angle cases.

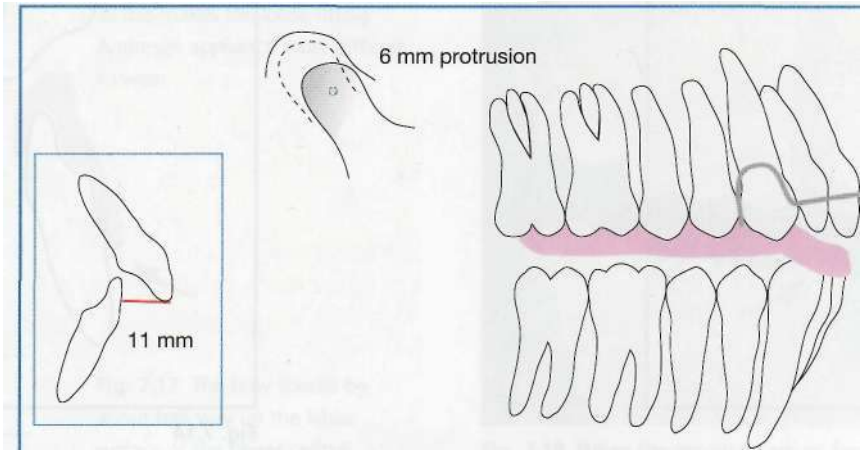


Fig. 7.12 Up to 7 or 8mm of protrusion is normally well accepted by the patient.

THE 'FIT APPLIANCE' APPOINTMENT

Adequate time should be scheduled to ensure that the 'Fit' appointment is an unhurried experience, preferably in a quiet side surgery.

Long-term experience suggests that it is beneficial if appliance fitting and subsequent adjustments are carried out with only the patient and an assistant present. This provides a basis for a good patient-orthodontist relationship, which may lead to better cooperation than a three-way arrangement of patient-orthodontist-parent. Where appropriate a parent can be invited in at the end of each appointment.

FITTING THE APPLIANCE - IT HAS TO BE COMFORTABLE

There are three main mechanical requirements when fitting the Andresen appliance:

1. It is necessary to ease the acrylic in the lingual sulcus areas, particularly adjacent to the molars and lower anteriors (Figs 7.13 & 7.14) by grinding away a little acrylic and then polishing the adjusted surface, because these are common areas of soreness if not eased in this way. Although the technician can do this routinely during construction of the appliance, it may be preferable for the orthodontist to carry out this simple but important procedure, which takes only one or two minutes at chair-side.

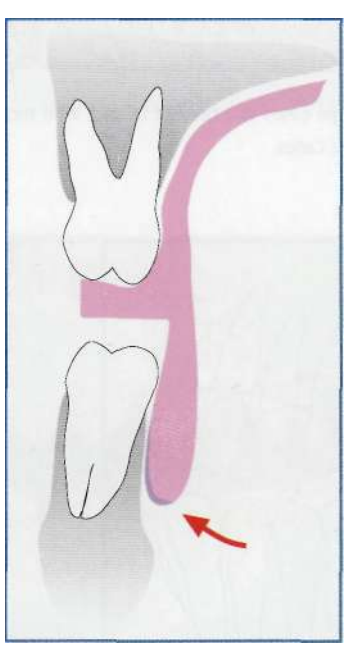


Fig. 7.13

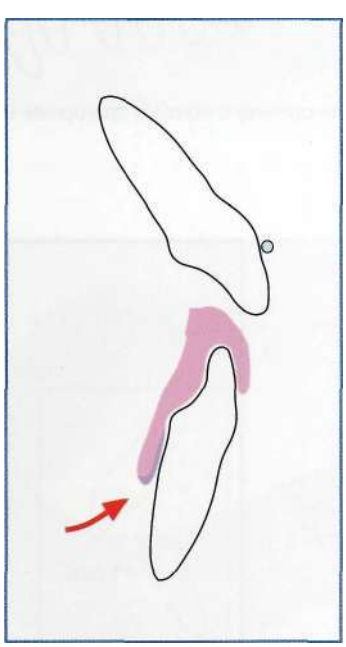


Fig. 7.14

Figs 7.13 and 7.14 It is necessary to ease the acrylic in the lingual sulcus areas, particularly adjacent to the molars and lower anteriors.

The labial bow must be passive, otherwise the appliance will not be worn. The bow should be about halfway up the labial surface of the upper incisors and resting passively on the enamel surface, or fractionally away from it (Figs 7.15, 7.16, & 7.17).

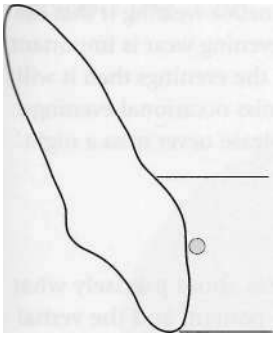


Fig. 7.15 The bow shouldbe resting passively on the enamel surface, or fractionally awayfrom it.

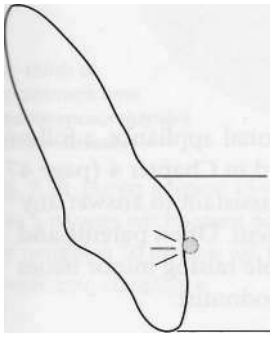


Fig. **7.16** The bow should not be pressing onto the enamel surface, as this makes the loose-fitting Andresen appliance more difficult to wear.

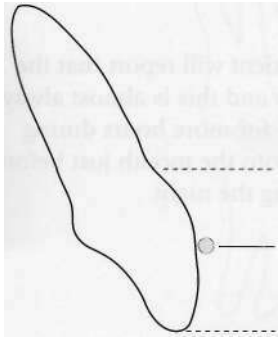


Fig. **7.17** The bow should be about half way up the labial surface of the upper central incisors crowns, and resting passively on the enamel surface.

During appliance construction acrylic needs to be cleared to allow unimpeded eruption of lower molars and premolars (Figs 7.18 & 7.19). This is of greater importance in the low-angle, over-closed cases. The work of the technician needs to be checked and more acrylic removed if necessary.

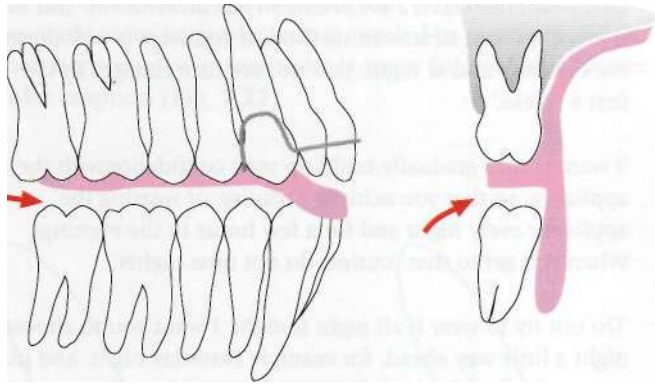


Fig. 7.18 Acrylic needs to be cleared to allow unimpeded eruption of lower molars and premolars. This is more important in the low-angle over-closed cases.

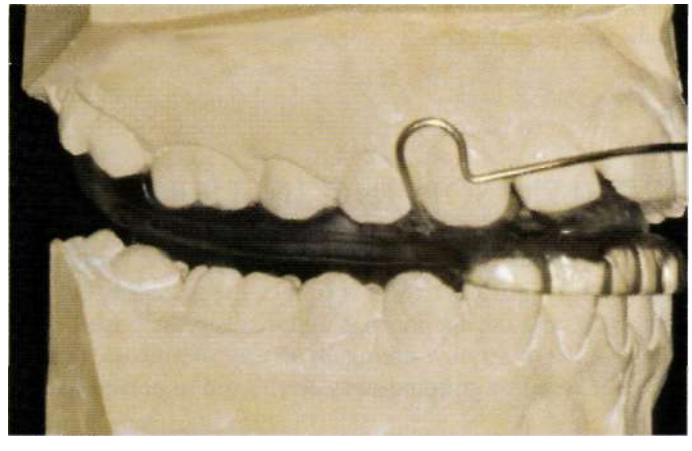


Fig. 7.19 When the appliance arrives from the laboratory the work of the technician needs to be checked to ensure enough acrylic has been removed above the lower premolars and molars.

PATIENT INSTRUCTIONS AT THE 'FIT APPLIANCE' APPOINTMENT

The need to curb overenthusiasm

Too much wear of the Andresen at the outset can lead to muscle and other soft-tissue soreness, which is discouraging. It is therefore necessary to curb any overenthusiasm of the patient and parents at the start, and suggest a progressive build-up of hours.

'The appliance is exactly as it should be. An experienced technician has taken a lot of care in its construction, and this is a well-proven treatment method. If you wear it well during the evenings and at night, you will see nice changes in the first 6 weeks.'

'I want you to gradually build up your confidence with the appliance, so that you achieve a routine of wearing the appliance every night and for a few hours in the evenings. When you get to that routine, do not miss nights.'

'Do not try to wear it all night tonight. I want you to choose a night a little way ahead, for example Saturday night, and plan to wear it all night then. Between now and Saturday try to wear it for a few periods of 20 or 30 minutes in the evenings, and progressively get used to it, increasing the evening hours.'

'Although we have taken the utmost care in construction, about one time in ten these appliances rub the soft tissue, and make a sore place. It is unlikely this will occur, but if it does please call us and come in with the appliance for a very quick adjustment. We can easily and rapidly make it absolutely comfortable.'

'There are only two places the appliance can be - in your mouth or in its box. Keep it clean with a little toothpaste and a toothbrush using cold water, and please remember that it can never go into hot water. Keep it away from pets'

'If you can manage 10 to 12 hours out of each 24 that will be excellent. It helps to choose a routine for wearing it that fits in with your family schedule. The evening wear is important, because if it is not worn enough in the evenings then it will tend to fall out at night. You may miss occasional evenings, for important family reasons, but please never miss a night.'

Patient advice sheet

Orthodontists will have different ideas about precisely what instructions should be given to each patient, and the verbal advice may need to have a different emphasis for certain individuals. However, many of the key points are included above, and it is helpful to produce a written advice sheet, to support the verbal information.

The follow-up phone call

About a week after fitting the functional appliance, a follow-up phone call is helpful, as discussed in Chapter 4 (page 47). This is a chance for an experienced assistant to answer any queries and to re-encourage the patient. Often parents and the patient will feel more comfortable raising minor issues with an assistant than with the orthodontist.

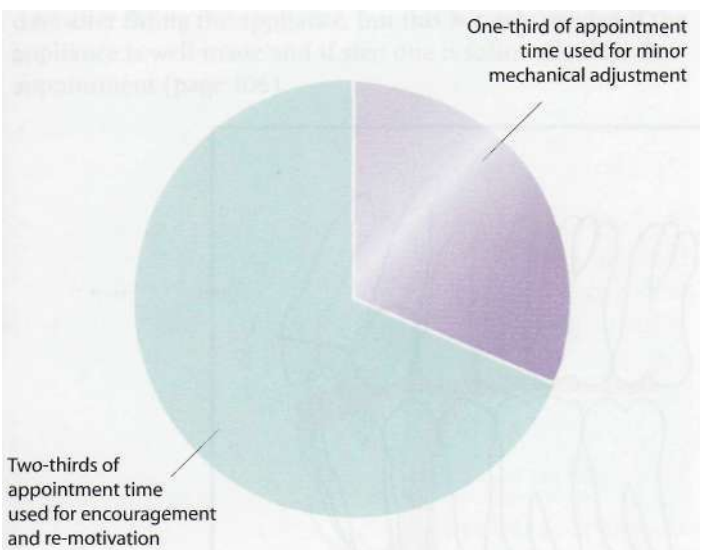
PROBLEM SOLVING IN THE EARLY STAGES

There are normally very few problems early in the functional stage, provided case selection is correct, the patient is well motivated, and the appliance is well made. If there is soreness due to acrylic rubbing on an area of mucosa, this can be relieved by grinding away acrylic and re-polishing in the normal way. Sometimes the patient will report that the appliance tends to fall out at night, and this is almost always remedied by wearing the appliance for more hours during the evening. If the appliance goes into the mouth just before bedtime it is likely to fall out during the night.

ADJUSTMENT VISITS

The first adjustment visit

The Andresen is normally checked every 6 weeks, and it is helpful if 15 minutes is scheduled for the first and each subsequent adjustment visit. As discussed in Chapter 4, it is probable that only 5 minutes will be spent doing minor mechanical adjustments, and the remaining 10 minutes will be given to offering encouragement and re-enforcing compliance (Fig. 7.20).



Two-thirds of appointment time used for encouragement and re-motivation

Fig. 7.20 During a typical 15-minute adjustment visit it is probable that only 5 minutes will be spent doing minor mechanical adjustments, and the remaining 10 minutes will be given to offering encouragement and re-enforcing compliance.

At the first adjustment visit the appliance will normally be working well, giving a noticeable reduction in overjet and an improvement in facial appearance, which is motivational for the patient and parents. Mechanically, it is necessary to repeat steps two and three, as at the 'Fit' appointment (pages 106 & 107). This ensures that the bow is correctly positioned vertically and resting passively on the enamel surface and that the lower molars are free to erupt (Fig. 7.21). For the low-angle cases particular care is needed to remove acrylic when necessary, to ensure there is space for continued lower molar eruption (Fig. 7.22).

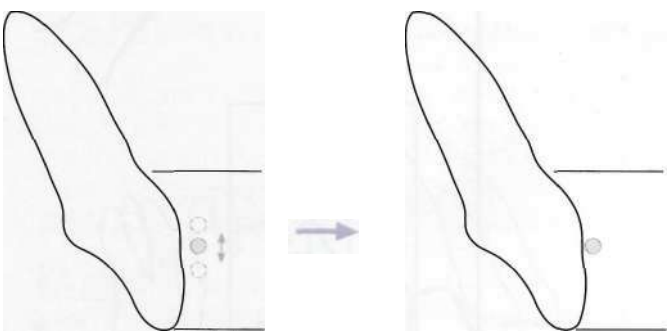


Fig. 7.21 At adjustment visits it is necessary to ensure that the bow is correctly positioned and resting passively on the enamel surface.

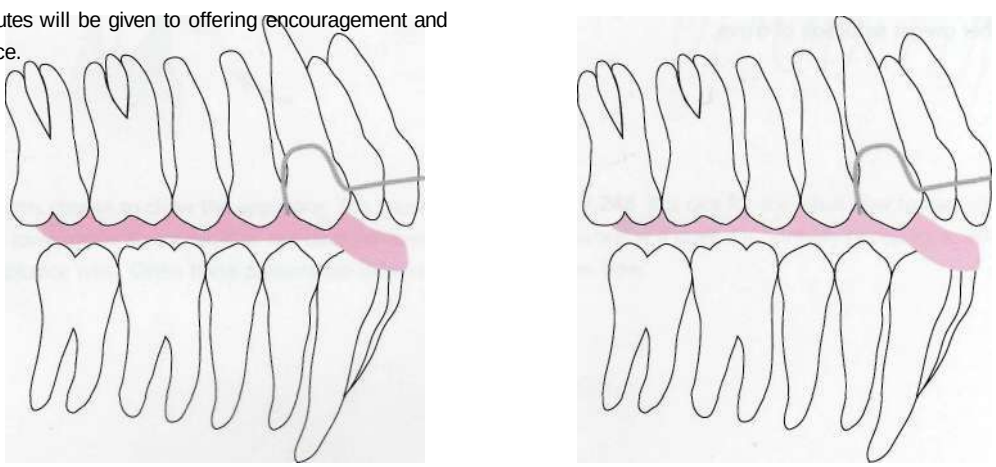


Fig. 7.22 Care is needed to remove acrylic when necessary at adjustment visits. This is important for low-angle cases, to ensure that there is space for continued lower molar eruption.

Subsequent adjustment visits

The aim is to achieve an overjet reduction of 1 or 2 mm every visit, and if compliance is good a 10 mm overjet can be corrected within 6 months. Mechanically, steps two and three from the 'fit' appointment (pages 106 & 107) are repeated at each visit. It is necessary to check that the Andresen is still 'active' as the overjet reduces, by making sure that the mandible is postured forward when the appliance is in place. Surprisingly, posturing of as little as 2 or 3 mm is often enough for progress to continue. Obviously, there will be a need for a second Andresen if the posturing is only 2 mm and there is a need for further overjet reduction of, say, 6 mm (Fig. 7.23).

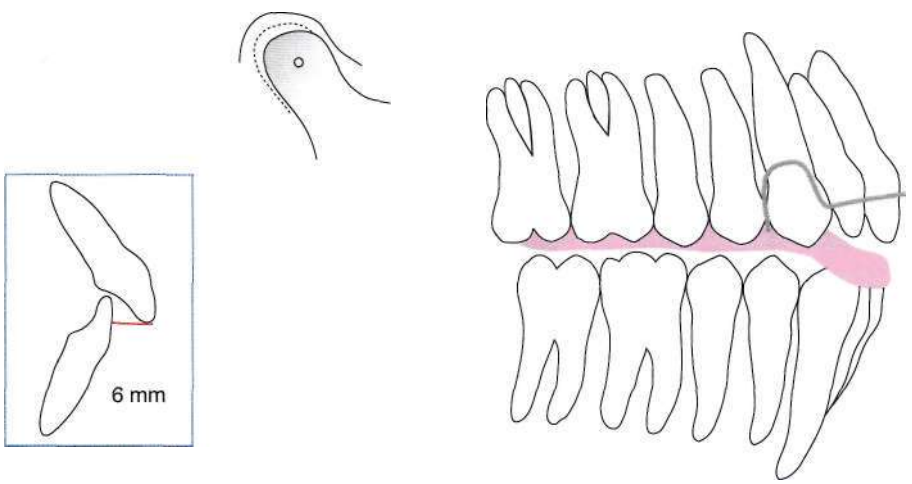


Fig. 7.23 At each adjustment visit it is necessary to check that the Andresen appliance is still 'active' as the overjet reduces. A second Andresen appliance will be required if the posturing is only 2 mm and the case needs further overjet reduction of 6 mm.

PROBLEM SOLVING

Compliance

In Chapter 4 extensive information is given on methods of optimizing patient cooperation. It is important to identify poor patient compliance at an early stage, and to try to improve it (page 48).

Soreness due to rubbing

It may be necessary to remove small amounts of acrylic a few days after fitting the appliance, but this is rarely needed if the appliance is well made and if step one is followed at the fit appointment (page 106).

Acrylic chewing

A few patients choose to chew the appliance, and this causes some roughness in the lower molar sulcus regions (Fig. 7.24A). This may be seen in cases that are going well, and, surprisingly, the acrylic roughness does not seem to delay progress. These are generally 'good compliance' patients, and the acrylic needs to be smoothed and polished during the adjustment visit, with a few friendly words: 'You're making excellent progress, but please don't chew the appliance.'

Broken bows (rare)

It is rare for the wire of a labial bow to fracture (Fig. 7.24B). The orthodontic technician will normally be involved if a breakage occurs, and a new bow is the best solution.

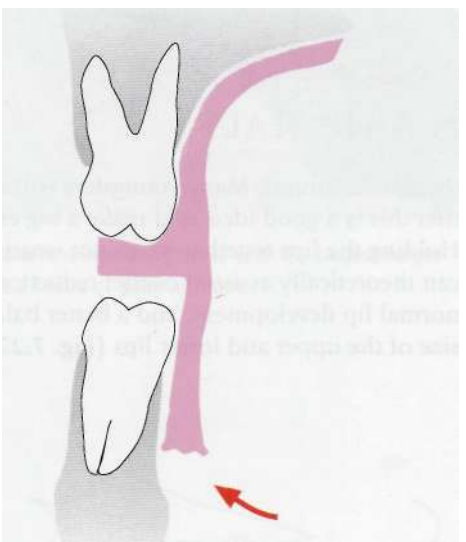


Fig. 7.24A A few patients choose to chew the appliance. This causes some roughness in the lower molar sulcus regions, but does not seem to interfere with good appliance wear. Often these patients are showing first-class compliance.

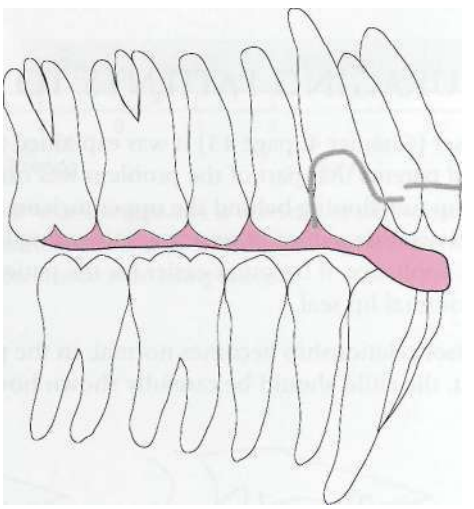


Fig. 7.24B It is rare for the labial bow to fracture on an Andresen appliance. If it does it is normally necessary to ask the technician to make a new bow.

REDUCING HOURS IN THE LATER STAGES

As soon as the overjet and overbite are close to normal levels, the hours of wear can be reduced from 'evenings and nights' to 'one hour in the evening and sleeping,' or 'sleeping only' (Figs 7.25 & 7.26).

The only purpose of the Andresen appliance at this point is to hold the corrected lip function and incisor relationship, and this can easily be achieved with reduced hours. The child can be informed that this is a reward for good compliance, and it is a further kindness to proceed into the fixed appliance stage without delay.

In most cases there is no advantage to continuing with the Andresen for more than a month after the incisor relationship has been corrected. It is best practice to proceed into fixed appliances without delay, and this requires some pre-planning. It can be valuable motivation: 'You have made excellent progress and in one month from now we can go into fixed braces. That's really good.'

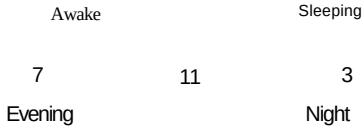


Fig. 7.25 At the start of treatment the Andresen should be worn for three waking hours and while sleeping.

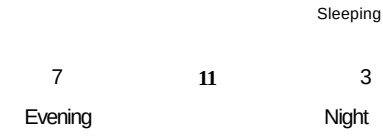


Fig. 7.26 Hours of wear can be reduced to one hour in the evening and while sleeping, as soon as overjet and overbite are close to normal levels.

ENCOURAGING PATIENTS TO MAINTAIN A LIP SEAL

At the outset (Chapter 4, page 43) it was explained to the patient and parents that part of the problem was caused by the lower lip functioning behind the upper incisors. As the overjet and overbite reduce in response to wearing the functional appliance, it becomes easier for the patient to achieve a normal lip seal.

As the incisor relationship becomes normal, in the presence of a parent, the child should be carefully shown how to hold the lips in contact. Many youngsters will quickly understand that this is a good idea, and make a big effort to comply. Holding the lips together when not wearing the Andresen can theoretically assist in overjet reduction. It also encourages normal lip development, and a better balance between the size of the upper and lower lips (Fig. 7.27).

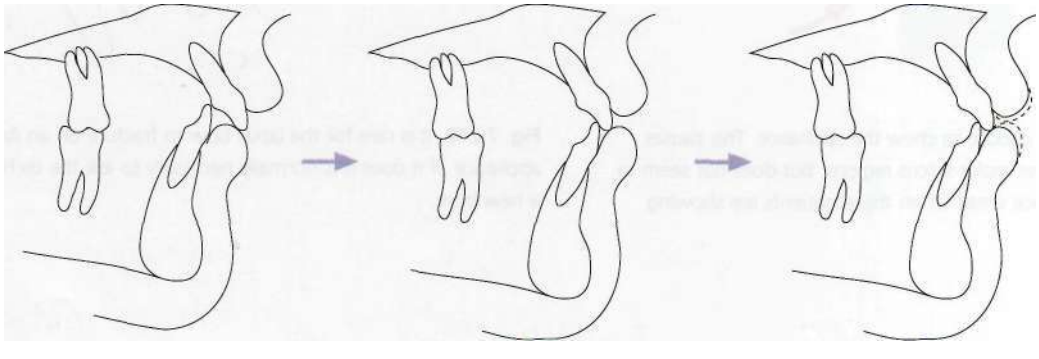


Fig. 7.27 As the incisor relationship becomes more normal, holding the lips together when not wearing the appliance can theoretically assist in further overjet reduction and encourage normal lip development, as advocated by Dr Andresen.

GROWTH HORMONE RELEASE DURING SLEEP

Standard physiology texts[2] suggest that growth hormone is released in a pulsatile manner, with the largest surges occurring during the first 2 hours of sleep at night (Figs 7.28 & 7.29) and orthodontic research workers have commented on this.[3] The number of spontaneous pulses depend on age, and in adolescents they are thought to increase during the growth spurt. Growth hormone exerts its anabolic effects through insulin growth factor I, so the action is not direct. It is logical to expect the long bones (and the mandible) to respond to this cycle, with almost all their increase in length occurring in a few night-time hours, followed by a period of consolidation.

Fig. 7.28 Growth hormone is released in pulses, with the largest surges occurring during the first 2 hours of sleep at night.

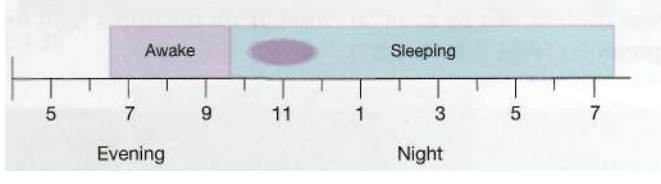


Fig. 7.29 The Andresen appliance is worn during the evenings and at night, and this takes advantage of the surges in growth hormone that are believed to occur soon after falling asleep.

CASE MZ

This Polish girl was aged 10 years and 7 months when she presented with a low-angle Class II division 1 malocclusion, with MM angle of 18 degrees. The A/P skeletal pattern was Class I, with an ANB of 3 degrees and a Wits of + 2 mm. The patient seemed to be a determined individual and it was felt that compliance would be good.

The facial profile reflected the underlying malocclusion (Figs 7.30 & 7.32). During the assessment the patient was asked to protrude the mandible to simulate the profile with a corrected overjet (Fig. 7.31).

Dentally, the patient showed an uncrowded Class II division 1 dentition with an overjet of 9.5 mm, a deep bite, and proclined upper incisors (Figs 7.33, 7.34, & 7.35). There was slightly early dental development but both the upper primary canines remained present, with the permanent upper canines some way from eruption, and the possible need for extraction of the primary canines was discussed. There was a lower midline discrepancy of 3 mm to the left, and the case was complicated by a buccal crossbite on the upper right first premolar (Figs 7.36 & 7.37).

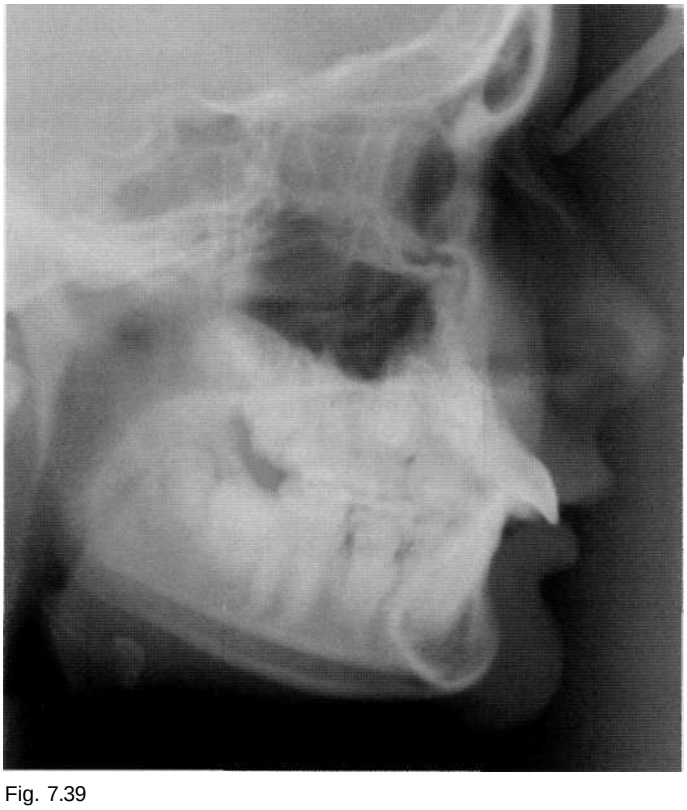


Fig. 7.39

Fig. 7.30

Fig. 7.33

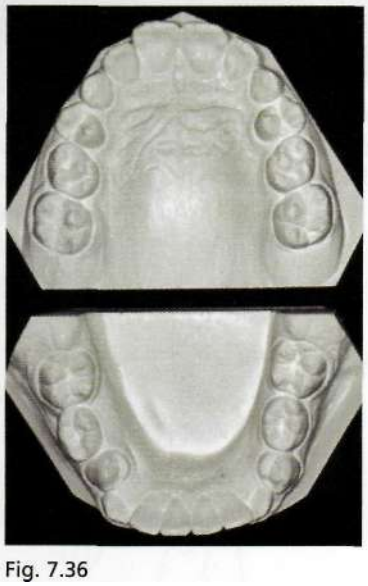


Fig. 7.36

It was estimated that overjet correction would require two Andresen appliances for up to 9 months, followed by fixed appliances for about 18 months, and that a lower acrylic splint (Fig. 7.38) would be needed during the early part of the fixed appliance stage to deal with the premolar crossbite.

Fig. 7.31

Fig. 7.32

Fig. 7.34

Fig. 7.35

Fig. 7.37

Fig. 7.38

Case MZ age 10.7

SNA	88°
SNB	85°
ANB	3°
Wits	+ 2 mm
MM	18°
U1 to Max plane	122°
L1 to Mand plane	103°

Fig. 7.40

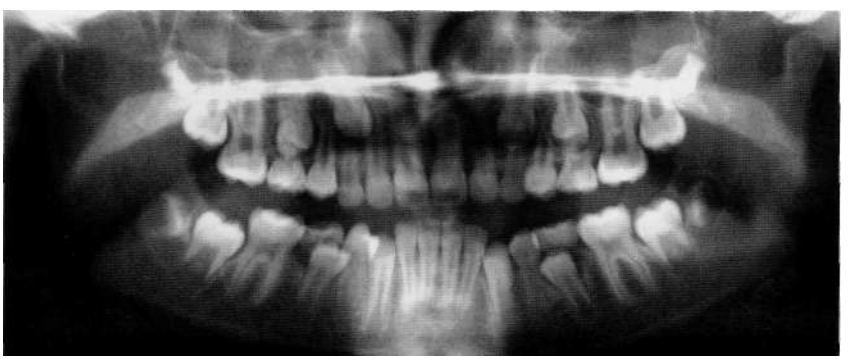


Fig. 7.41

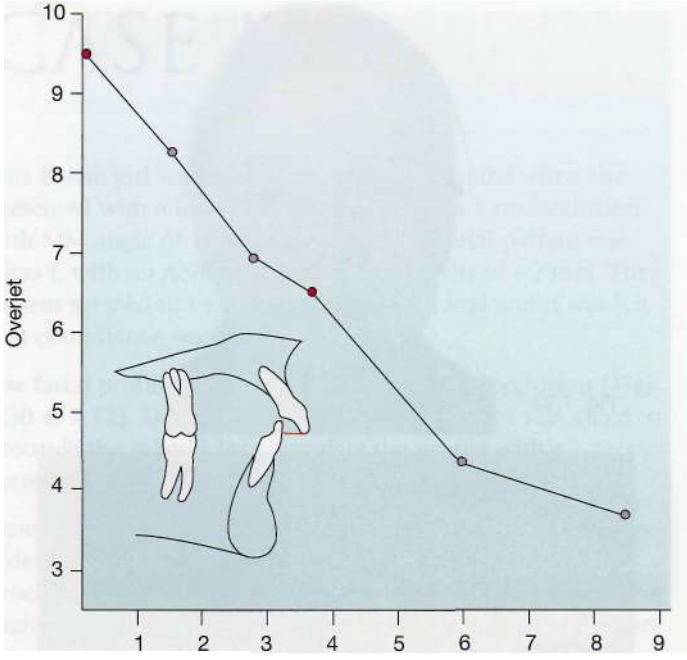


Fig. 7.42

The first Andresen was constructed using a wax bite with the mandible protruded approximately 6 mm. It was fitted at age 11.2 years and was worn for 4 months. A second Andresen appliance was constructed using an edge-to-edge wax bite and this was used for 5 months. The overjet was reduced in this way from 9.5 mm to 3.5 mm using the two Andresen appliances for a total of 9 months (Fig. 7.42) and a pleasing facial improvement was achieved during this time (Figs 7.44 & 7.45) compared with pre-treatment (Fig. 7.43).

At age 11.11 years a lower splint was fitted for full-time wear and full-size metal upper fixed appliances were placed with a .0175 multistrand leveling wire (Figs 7.46, 7.47, & 7.48). The splint was needed to free the occlusion so that the upper right first premolar could move palatally. At this time the upper primary canines were loose and therefore they were allowed to be shed naturally.

At age 12.2 years the splint was discontinued and lower arch fixed appliances were placed with a lower .016 HANT aligning wire (Figs 7.49, 7.50, & 7.51). The lower right second premolar (Fig. 7.50) had a tube welded onto a conventional bonding base. This is preferable to the offset type of bonding base on the lower left second premolar (Fig. 7.51), which can interfere occlusally. In the upper arch a .016 round steel wire was in place to guide the upper right canine palatally.

One month later the upper permanent canines were starting to erupt. A rectangular .019/.025 HANT wire with a square arch form was placed in the upper arch, and a .016 round steel wire in the lower arch (Figs 7.52, 7.53, & 7.54).


Fig. 7.43


Fiq. 7.46


Fig. 7.49

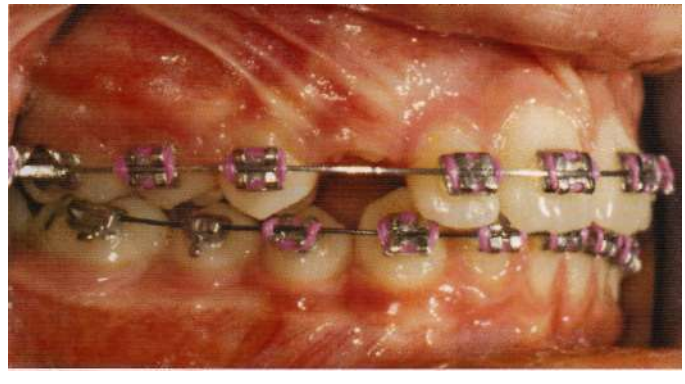


Fig. 7.52

Fig. 7.44

Fig. 7.45

Fig. 7.47

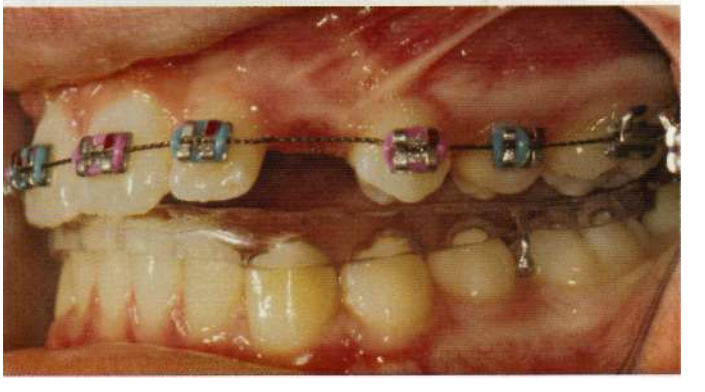


Fig. 7.48

Fig. 7.50

Fig. 7.51

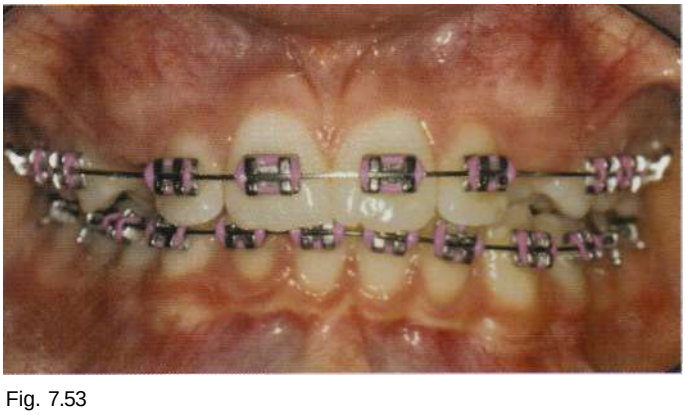


Fig. 7.53

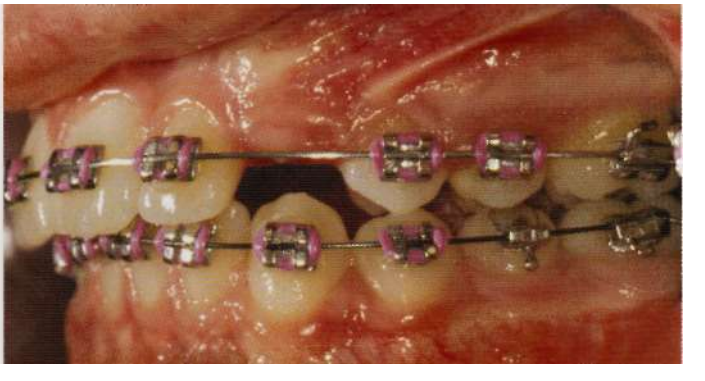


Fig. 7.54

At age 12.5 years tubes were bonded onto lower second molars to assist in overbite control and prevent vertical discrepancies (Fig. 7.58). It eventually became possible to bond brackets onto the long-rooted upper canines at age 12.7 years. There was a bilateral tip error with bracket positioning, and this is a risk when bonding onto partly erupted teeth (Figs 7.55, 7.57, & 7.64). This could have been corrected by bracket repositioning on the upper canines as the treatment progressed, but it was decided to accept this shortcoming in canine tip position, to avoid further extending the treatment time.

At age 12.10 years conventional upper and lower rectangular steel .019/.025 wires were in place in the upper and light (80 Gm) Class II elastics were being worn at night to control the overjet and assist in overbite control (Figs 7.55 to 7.57, 7.59, & 7.60). The initial lower wire was thinned in the second molar region for ease of insertion.

Steel rectangular working wires were used for a further 4 months to over correct the overbite and overjet (Figs 7.61, 7.62, & 7.63), with a flat upper-arch wire and a small amount of reverse curve of Spee bent into the lower wire (Figs 7.65 & 7.66).

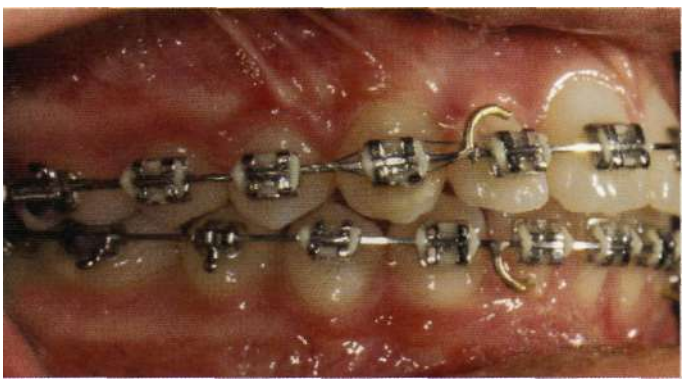


Fig. 7.55

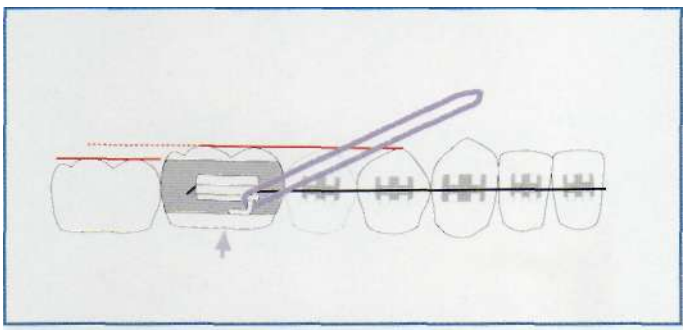


Fig. 7.58

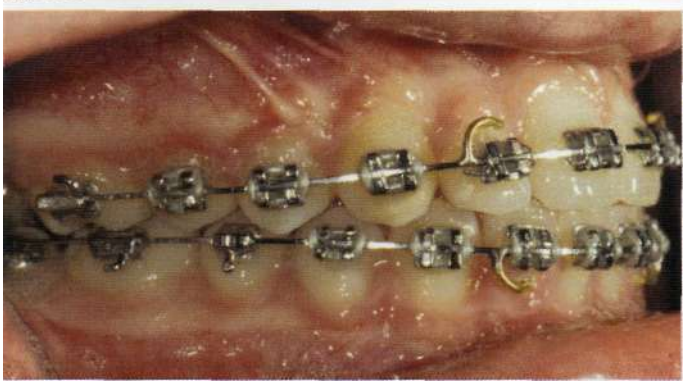


Fig. 7.61

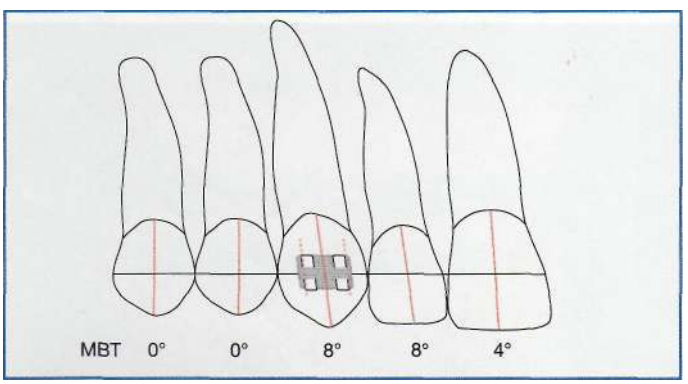


Fig. 7.64

Fig. 7.56

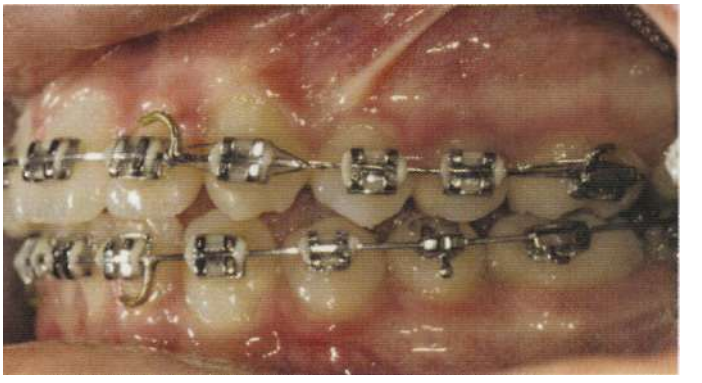


Fig. 7.57

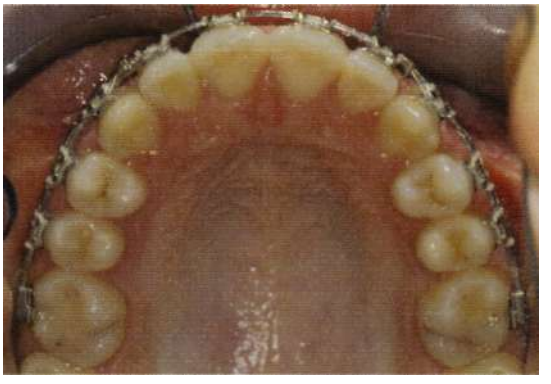


Fig. 7.59

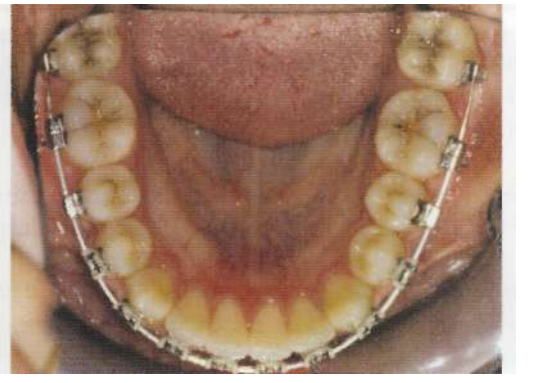


Fig. 7.60

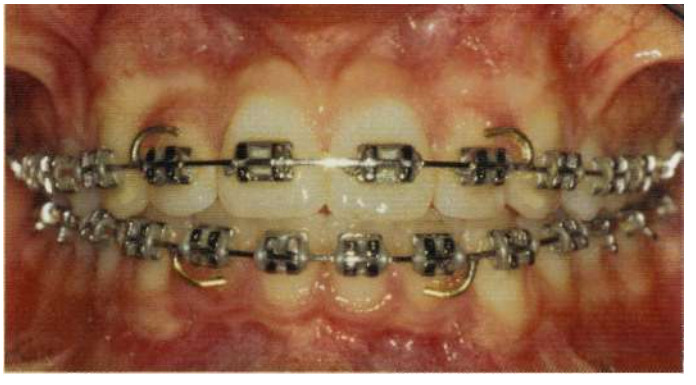
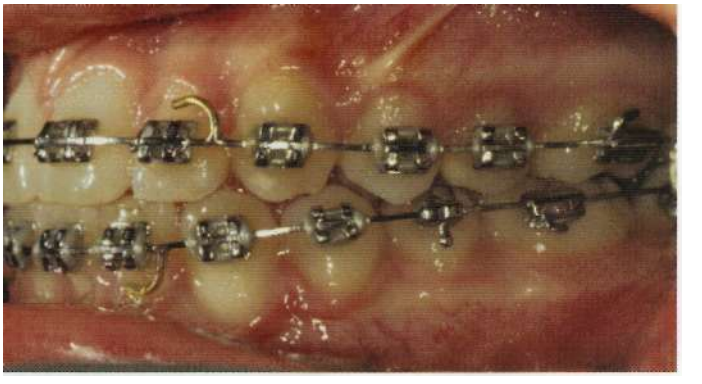


Fig. 7.62



ililtes

Fig. 7.63

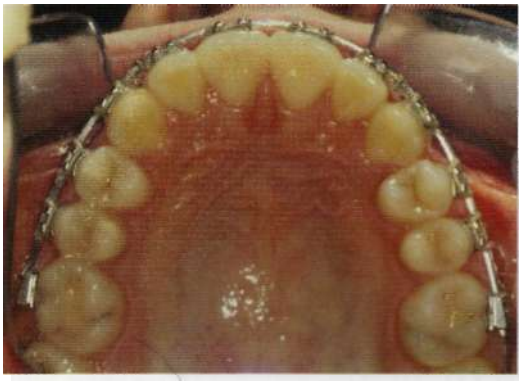


Fig. 7.65

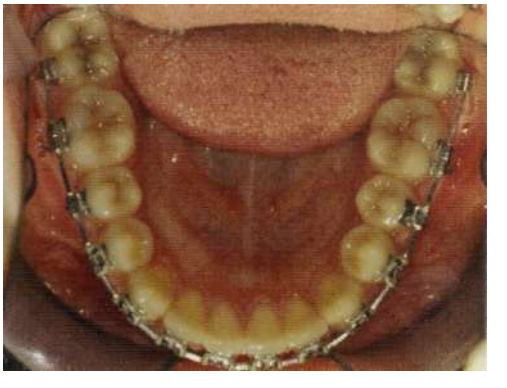


Fig. 7.66

The patient had a Class I occlusion and pleasing facial harmony at the end of treatment (Figs 7.67, 7.68 & 7.69) at age 13.3 years, with the facial profile reflecting the Class III growth that had occurred. As with Case OD (page 78), the three-quarter smile view (Fig. 7.73) has a suggestion of retrognathism, indicating that headgear is generally contraindicated in this type of case. A tooth positioner was used for 8 weeks before proceeding into normal retention at age 13.5 years.

Cephalometrically, the MM angle remained low at the end of treatment, but the patient was not well positioned in the head holder, so it is difficult to draw conclusions from the radiograph (Fig. 7.76). Although upper incisors are at a good torque position, lower incisors are clearly proclined, and could have been better positioned, possibly with some enamel reduction. Upper canine roots appear unusually long, which may explain the slow eruption.

Progress of this case was slower than expected and the overall treatment time of 25 months was partly due to a delay while awaiting eruption of the upper canines. However, appointments were invariably scheduled at the end of the afternoon, when everyone was tired, and there were sometimes 2 months between visits during the fixed-appliance stage, instead of the recommended 1 month. It is felt that these attendance factors contributed to the extended treatment time.

Fig. 7.67

Fig. 7.70

Fig. 7.73

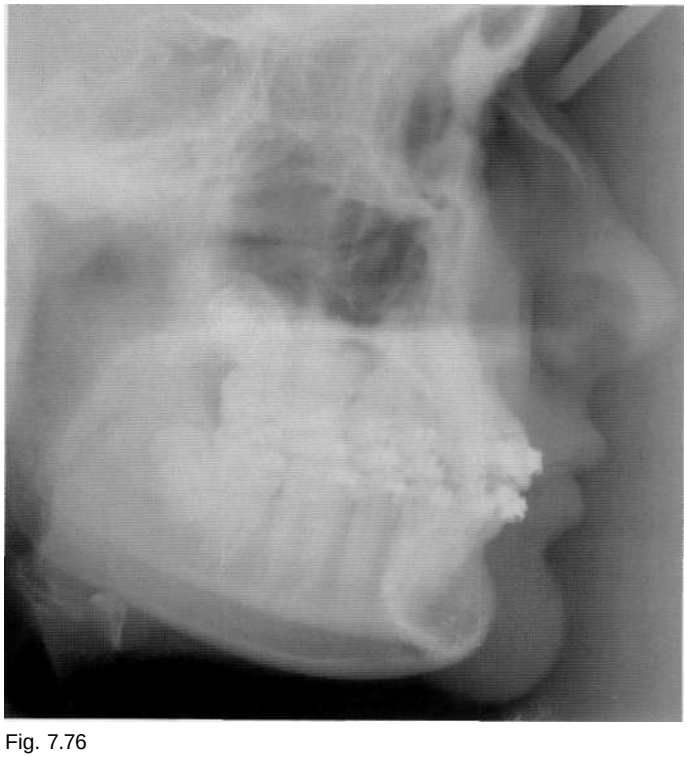


Fig. 7.76

Case MZ age 13.4

SNA	86°
SNB	86°
ANB	0°
Wits	-3mm
MM	14°
U1 to Max plane	117°
L1 to Mand plane	103°

Fig. 7.77

Fig. 7.68

Fig. 7.69

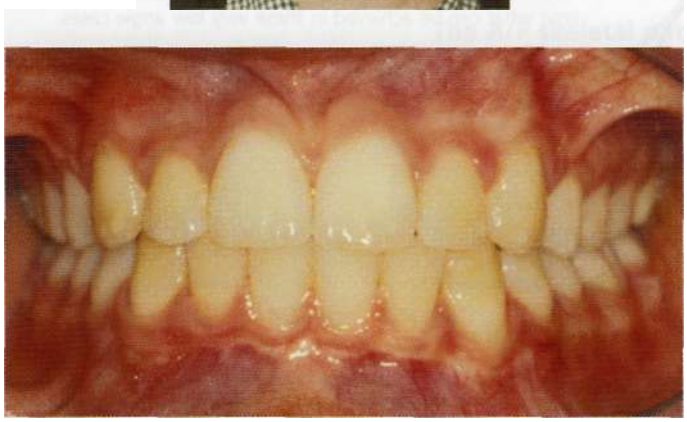


Fig. 7.71

Fig. 7.72

Fig. 7.74

Fig. 7.75

Fig. 7.78

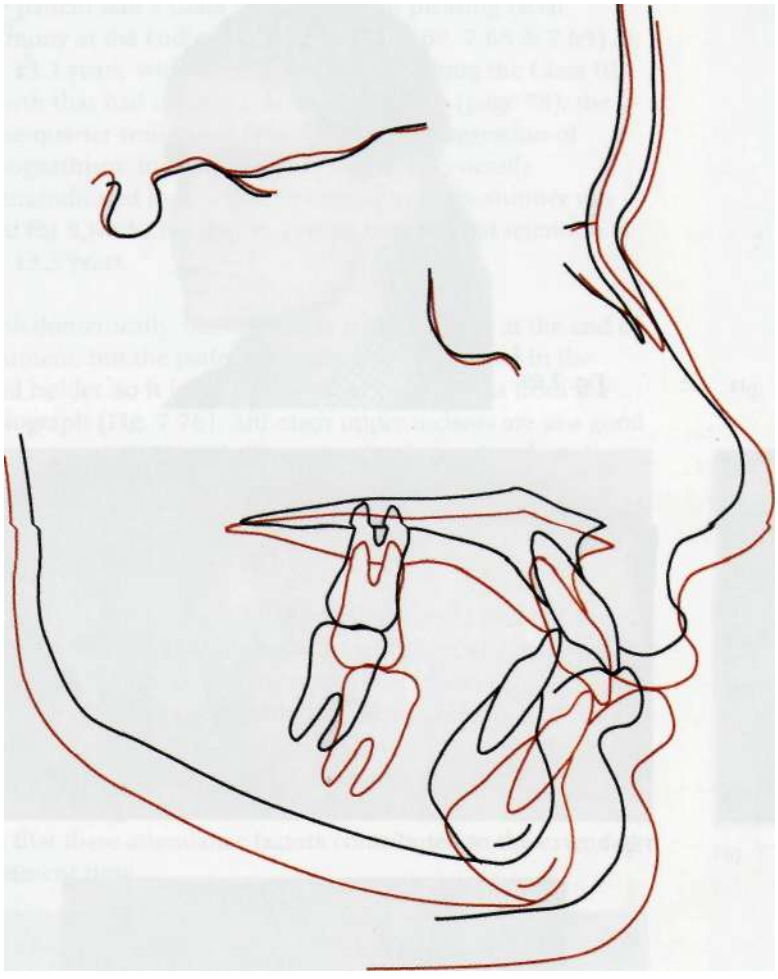


Fig. 7.79 The case MZ before and after tracings are shown at 80% of actual size, and are superimposed on sella-nasion line at sella. The active treatment lasted 25 months and probably contributed to the considerable downward and forward growth between the ages of 10.7 and 13.4, with the skeletal pattern changing from Class I to Class III. In the lower anterior region a little more lingual crown torque could have been attempted by enamel reduction and torque control mechanics (page 131) but atypical bone anatomy and a heavy bite often limit what can be achieved in these very low angle cases.

Case MZ	**age** 13.4	age 13.4
SNA	88°	86°
SNB	85°	86°
ANB	3°	0°
Wits	+ 2mm	-3mm !
MM	18°	14°
U1 to Max plane	122°	117°
L1 to **Mand** plane	**103°**	103°

REFERENCES

1 Arnett GW, McLaughlin RP 2004 Facial and dental planning for orthodontists and oral surgeons. Mosby, Edinburgh, 30

2 Emslie-Smith D, Bell GH 1988 Textbook of Physiology (BDS). Churchill Livingstone, Edinburgh

3 Tulloch JF, Proffit WR, Phillips C 1997 Influences on the outcome of early treatment for Class II malocclusion. American Journal of Orthodontics and Dentofacial Orthopedics 111:533-542

CHAPTER **8**

Managing the fixed-appliance stage

QUESTION

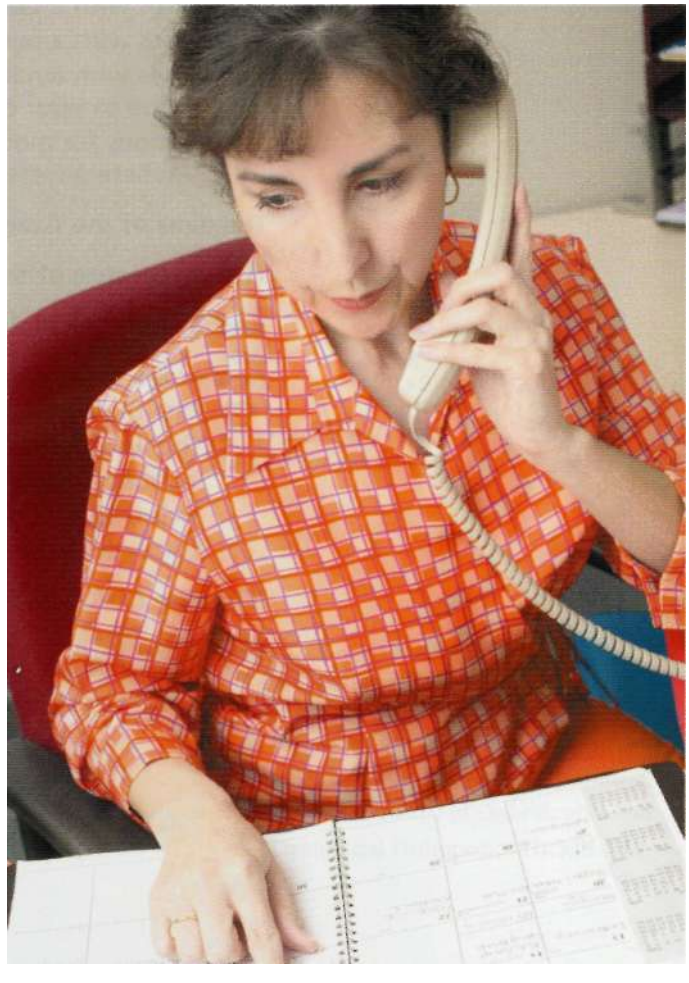
What is necessary for success in the fixed-appliance stage?

ANSWER

It is important to follow the well-tried principles of the MBT™ philosophy as described in 'Systemized Orthodontic Treatment Mechanics'[1], and respect the four elements of bracket choice, bracket placement, arch form, and force levels. The transition from functional appliance to fixed appliances needs to be carefully managed, with the early use of Class II elastics where necessary.

Appointment scheduling

During the final weeks with the functional appliance it is necessary to plan ahead and reserve a morning appointment for placement of the fixed appliances, as explained to the patient at the case presentation (Chapter 4, page 45). This avoids a delay between overjet correction and the fixed-appliance stage, and helps patient motivation. Lower molars may need to be banded for low-angle cases, and these individuals will require separators for a week before the set-up.



THE A/P SKELETALPATTERN GOING INTO THE FIXED-APPLIANCE PHASE

If case selection was correct (Chapter 3) the A/P skeletal pattern will normally be Class I or mild Class II as the functional-appliance stage comes to a close, so that the case can proceed uneventfully into fixed appliances. However, progress orthodontic records will need to be taken if there appears to be a moderate or severe Class II pattern, and treatment goals will need to be reviewed (see page 126 of this chapter).

Cases with a Class I skeletal pattern

If the A/P skeletal pattern is Class I as the case goes into fixed appliances, then an ideal result with correct upper and lower incisor torque should be possible (Fig. 8.1). Such treatments are normally easy to manage, and the fixed-appliance stage will often be completed in less than a year (Cases OD, page 74, and AR, page 90).

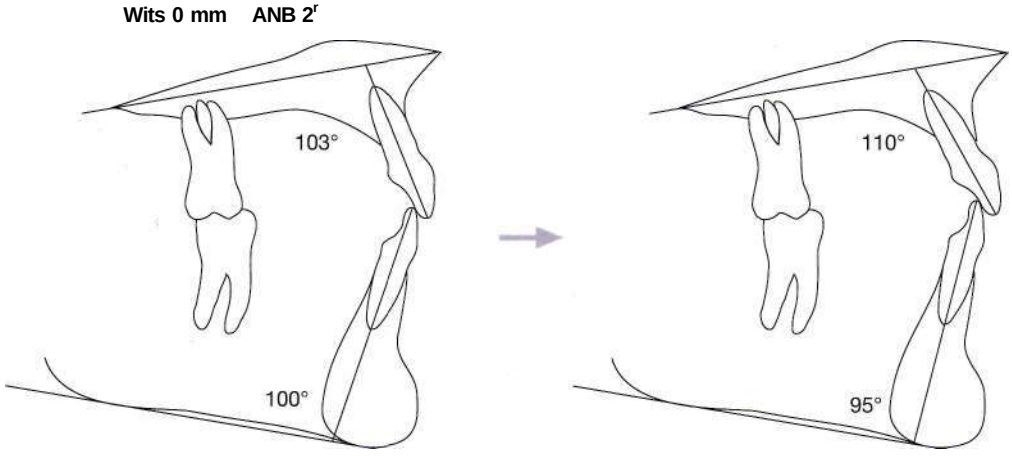


Fig. 8.1 If the skeletal pattern is Class I a result with correct upper and lower incisor torque should be possible.

Cases with a mild Class II skeletal discrepancy

Mild Class II skeletal cases require more careful management than Class I cases. During the fixed-appliance stage there may be favorable growth towards a Class I pattern, which will allow ideal incisor torque.

However, if the Class II skeletal discrepancy remains, there will be a need for dental compensation for the A/P relationship (Fig. 8.2), accepting a result with less-than-ideal incisor torque (Case DI, page 140).

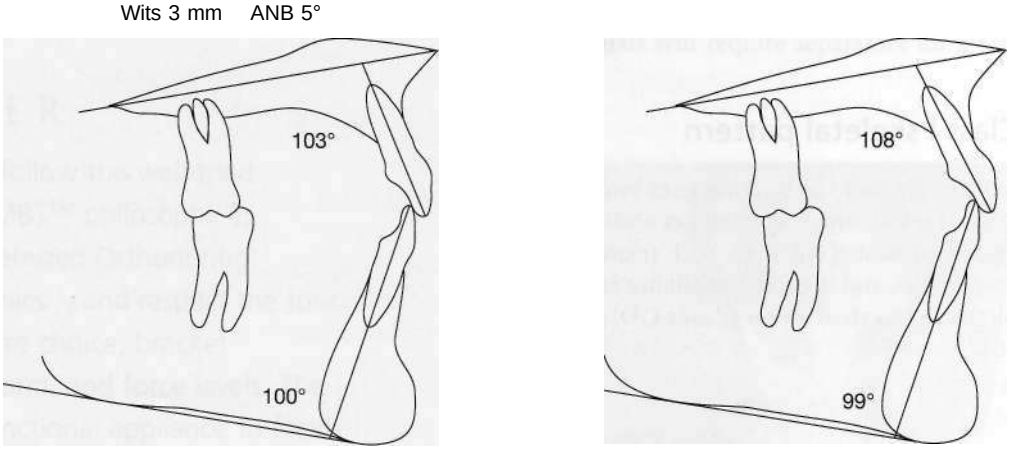


Fig. 8.2 If there is a Class II skeletal discrepancy there will normally be a need for dental torque compensation.

Cases with a mild Class II skeletal pattern and a residual overjet due to poor cooperation with the functional appliance

It is normally necessary to take new orthodontic records for these cases. The situation can be reviewed with the patient and the family, before agreeing to go into fixed appliances. All the options should be reviewed on the basis of: 'Where do we go from here?' Where appropriate the more severe cases can be assessed for correction with orthodontics alone, or with a combined orthodontics/orthognathic surgery approach, and the two outcomes compared.[2]

A normal fixed-appliance stage can be offered for mild Class II cases, on the understanding that good Class II elastic wear will be essential. In some treatments the extraction of upper second molars may be considered (Case AR, page 90) to assist treatment mechanics. If cooperation is likely to remain poor, then loss of upper first or second premolars may be a possibility for average-angle cases, treating out to a Class II molar result. This is seldom a good treatment option for low-angle cases.

Options for moderate or severe Class II skeletal cases or where adverse growth has occurred

If the case was incorrectly diagnosed as being a mild Class II skeletal problem, or if adverse growth has occurred, a moderate or severe Class II skeletal pattern may become evident during the functional appliance stage. It is important to recognize this. It is essential to reassess the case and explain the problem to the patient and the family, because fixed appliances alone will probably not deliver a satisfactory outcome. Attempts to do so can lead to excessive retroclination of the upper incisors or an unresolved overjet.

Therefore, before agreeing to go into fixed appliances the case will be reassessed and recommended for either orthodontic correction or combined surgical/orthodontic treatment, using a full diagnostic work up.[2] Part of the skill in Class II treatment planning lies in balancing the wish to avoid surgery against the unfavorable effect on facial profile that can result from excessive incisor torque compensation.[3]

THE AIMS OF THE FIXED-APPLIANCE STAGE

During the fixed-appliance stage it is necessary to:

1. Hold on to the corrected overjet.
2. Correct the tip on all teeth.
3. Correct the incisor torque, within skeletal limitations (page 132).
4. Correct the molar torque, within skeletal limitations (page 132).
5. A finish to an ideal result, within skeletal limitations.

'Systemized Orthodontic Treatment Mechanics'[1] ('Book 3') describes systemized treatment mechanics for preadjusted fixed appliances, and the reader is referred to Chapters 3, 5, and 7 in that volume for general information on 'case set-up,' 'leveling and aligning,' and 'Class II treatment.' The following pages focus on specific strategies to finish a case after overjet correction with the Andresen appliance.

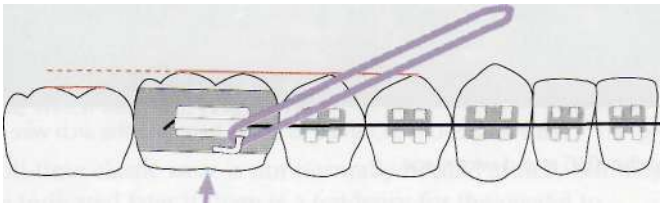


Fig. 8.3 Second molars need to be included to control the overbite, especially in low-angle cases, and to prevent a vertical step developing between first and second molars.

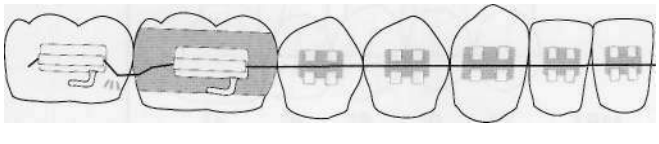


Fig. 8.4 If lower second molars are included at the set-up, when the patient is new to fixed appliances, there can be distortion of the aligning wires. It can be helpful to wait until the second or third visit to include them.

THE IMPORTANCE OF THE CASE SET-UP

High-quality bonding techniques are recommended to reduce the risk of loose brackets, and it is helpful if the patient eats only very soft food for 48 hours after the set-up, to allow the bonding agents to fully harden. Accurate appliance placement is essential, as recommended in Book 3, Chapter 3, with repositioning if necessary as treatment progresses.[1]

Second molars need to be included early in the fixed-appliance stage. This is necessary to control the overbite, especially in low-angle cases, and to prevent a vertical step developing between first and second molars, in response to the vertical element of the Class II elastics (Fig. 8.3).

However, it can be helpful to wait until the second or third adjustment visit to include second molars, or until the rectangular HANT stage, because inclusion of second molars is not essential until the heavier round steel wires are in place for overbite control or to support Class II elastics.

If lower second molars are included at the set-up, when the patient is new to fixed appliances, there can be distortion of the aligning wires (multistrand wires, or .016 HANT, or .014 or .016 round steel wires) in the lower first or second molar regions (Fig. 8.4).

This distortion can worsen the overbite and the position of the second molars. However, if inclusion of lower second molars is deferred until the second or third visit, heavier aligning wires, such as rectangular HANT, can sometimes be placed at the outset (Fig. 8.5). These resist distortion and can be quickly followed by rectangular steel .019/.025 working wires.

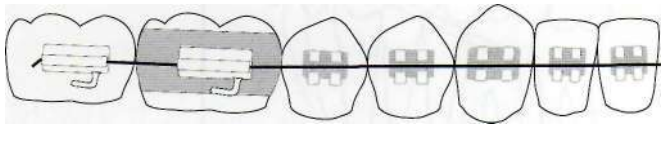


Fig. 8.5 If inclusion of lower second molars is deferred until the second or third visit, heavier aligning wires, such as rectangular HANT, can sometimes be placed at the outset, to avoid distortion.

ANCHORAGE CONTROL DURING THE CORRECTION OF TIP

At the end of the Andresen stage many cases have reasonably well-aligned teeth, but there may be some distal tipping of canines, premolars and molars. Soon after the start of leveling and aligning it is therefore helpful to ask the patient to wear very light Class II elastics during the evenings and when sleeping. These support anchorage, and help to prevent an increase in overjet as the crown tip is corrected.

Leveling and aligning normally commences with .015 multistrand or .016 HANT wires. These wires are regarded as being too light to support Class II elastics, but may be replaced with heavier wires after only a short time in these selected cases, which often have very little dental irregularity going into fixed appliances. In many cases round steel .016, or rectangular .019/.025 HANT wires can be placed within 3 weeks, and these wires will support light Class II elastics of 75 Gm or less, worn 12 hours out of each 24. During leveling and aligning Class II elastics can be carried to Kobayashi hooks or to hooks bent into the archwire **(Figs. 8.6** & **8.7)** (Cases AR, page 92, and DI, page 138).

Anchorage control, during the correction of tip, is achieved by:

» The use of light Class II elastics early in leveling and aligning (Fig. 8.8).

« Progressing slowly through the archwires in cases where tip correction is needed (Fig. 8.9). If too heavy wires are used too soon this threatens anchorage and brings the risk of an overjet increase.

- Using MBT™ brackets (page 89), which have reduced tip specification compared with the original SWA, and therefore put less demand on anchorage **(Fig. 8.10).**

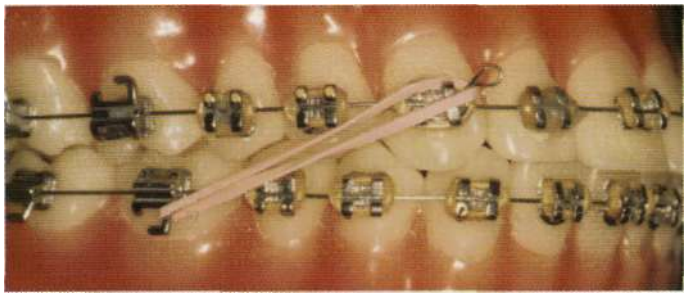


Fig. 8.6 Early in the leveling and aligning stage Class II elastics can be carried to Kobayashi hooks.

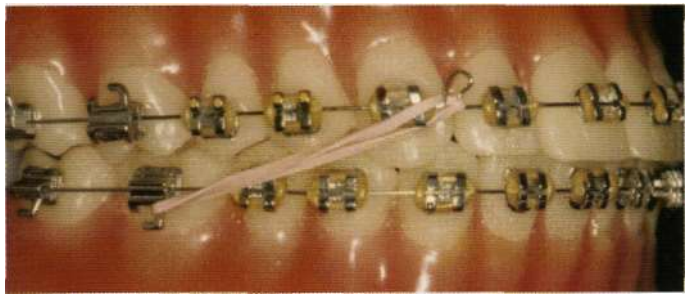


Fig. 8.7 Class II elastics can be carried to hooks bent into the arch wire at the .016 round-wire stage.

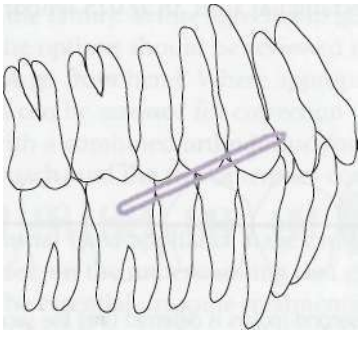


Fig. 8.8

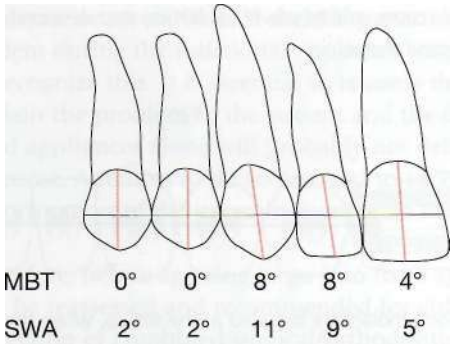


Fig. 8.10

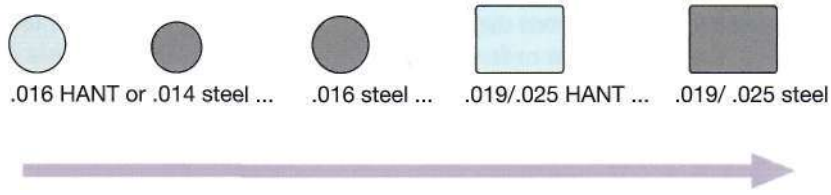


Fig. 8.9 It is helful to progress slowly through the archwire changes in cases where tip correction is required, to avoid loss of anchorage.

ANCHORAGE CONTROL DURING THE CORRECTION OF INCISOR TORQUE

Upper incisors become retroclined and lower incisors proclined during overjet correction with a functional appliance (page 60). Anchorage control is therefore needed to prevent an increase in overjet as the incisor torque is corrected by rectangular wires during the fixed-appliance stage.

As the case moves into rectangular wires, it is therefore normally necessary to ask the patient to continue wearing light Class II elastics, of 100 Gm or less, during the evenings and when sleeping (Fig. 8.11).

Full-time elastic wear is not normally needed at first, but may be indicated later if there is a tendency for the overjet to reappear. Predictably, there is often a need for more anchorage support from Class II elastics in cases with an underlying Class II skeletal pattern, or for cases which had a large starting overjet.

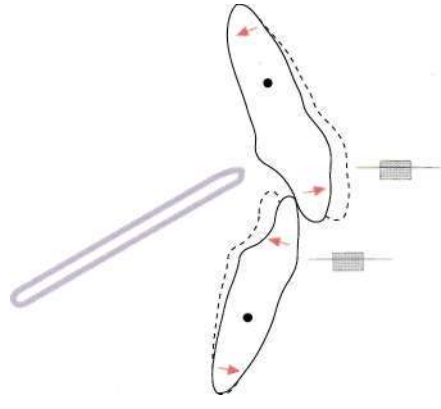


Fig. 8.11 As the case moves into rectangular wires, it is normally necessary to ask the patient to continue wearing light Class II elastics to prevent an increase in overjet as the incisor torque corrects.

Part-time versus full-time Class II elastics

Soon after the fixed appliances have been placed the patient is asked to wear light Class II elastics (100 Gm or less) during the evenings and when sleeping. This fits in with the routine that was followed with the functional appliance, and is well accepted by most children. The elastics unload the condyles, imitating the effect of the Andresen, and helping to release any potential growth at a time in the evening when levels of growth hormone are high (Chapter 7, page 113).

In conventional thinking, part-time elastic wear is held not to be effective in producing tooth movement. Thus the concept of part-time wear can be expected to assist overjet correction by the preferred method of releasing mandibular growth rather than by tooth movement. Later, full-time wear of Class II elastics can be considered to reduce any remaining overjet by tooth movement (Figs 8.12 & 8.13).

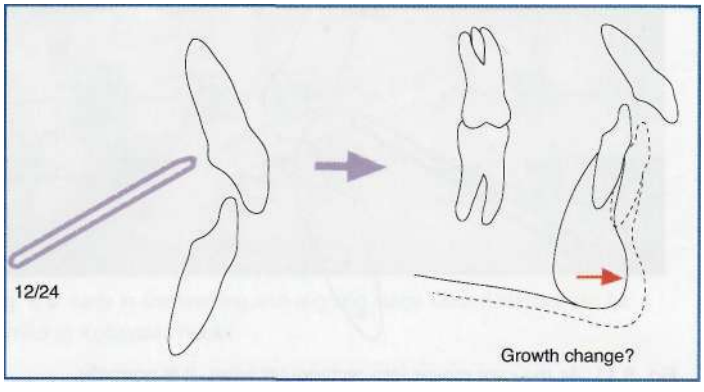


Fig. 8.12 Light elastics during the evenings and when sleeping unload the condyles, imitating the effect of the Andresen.

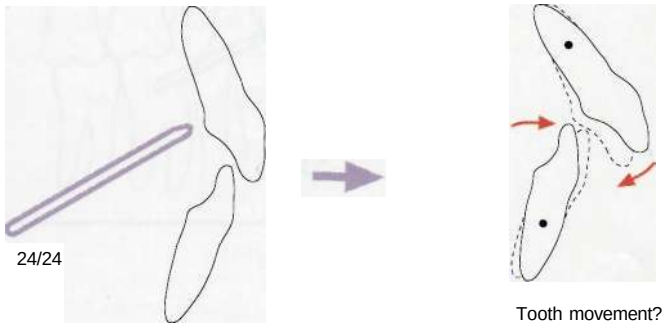


Fig. 8.13 Full-time wear of Class II elastics can be considered to reduce an overjet by tooth movement and release of growth.

The need for torque compensation

Ideal torque values for the incisors will normally be achievable for individuals with an average A/P and vertical skeletal pattern (Fig. 8.14), but this will probably not be possible for other cases. As with any orthodontic treatment, torque compensation will be needed if the underlying A/P and vertical features are not ideal.[3]

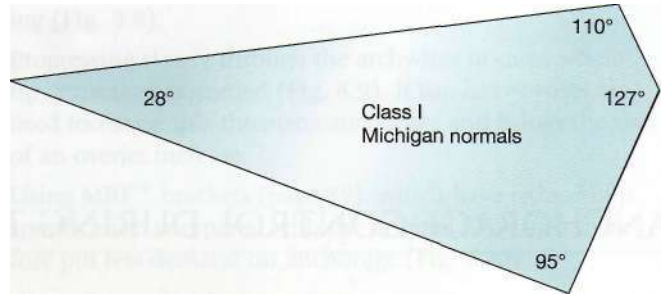


Fig. **8.14** A result with ideal torque values for the incisors will normally be achievable for individuals with an average A/P and vertical skeletal pattern. Torque compensation may be needed if the skeletal pattern is not ideal, as discussed later in this chapter.

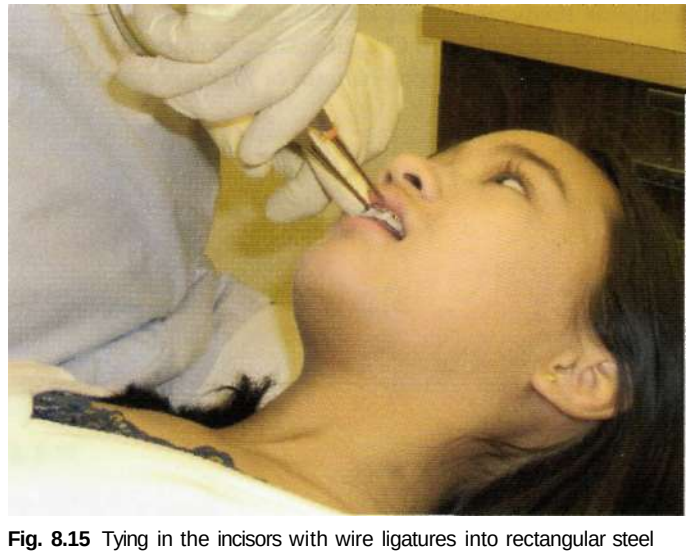


Fig. 8.15 Tying in the incisors with wire ligatures into rectangular steel .019/.025 wires may help the built-in torque to be expressed.

The MBT™ incisor brackets have extra torque control compared with the SWA, and good torque correction is easily achieved without wire bending in most of these selected non-extraction Class I or mild Class II cases. After placement of rectangular steel .019/.025 wires it may be necessary to allow a few visits for the built-in torque to be fully expressed, tying in the incisors with wire ligatures (Fig. 8.15).

In some cases extra torque can be added to the upper anterior region by wire bending (Figs 8.16 & 8.17).

Fig. 8.16 In a few cases it is helpful to add torque to the upper .019/.025 steel wire.

Extra torque correction can also be applied to the upper incisor by the use of a heavier .021/.025 rectangular HANT wire for one or two visits in these non-extraction cases, which do not require sliding mechanics. This has the effect of increasing the upper incisor torque specification by 6 degrees, due to the reduced slop (Figs 8.18 & 8.19). The .021/.025 HANT wire can also be helpful in the lower arch, for cases which need lingual crown torque in the lower incisor region.

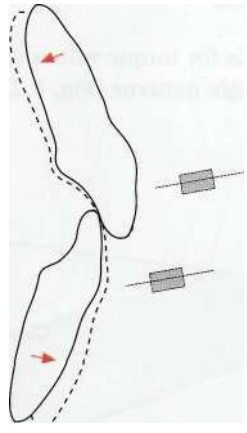


Fig. 8.17 The effect produced by bending torque into steel rectangular wires.

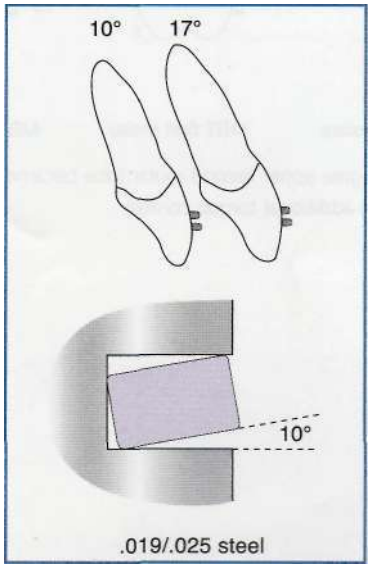


Fig. 8.18

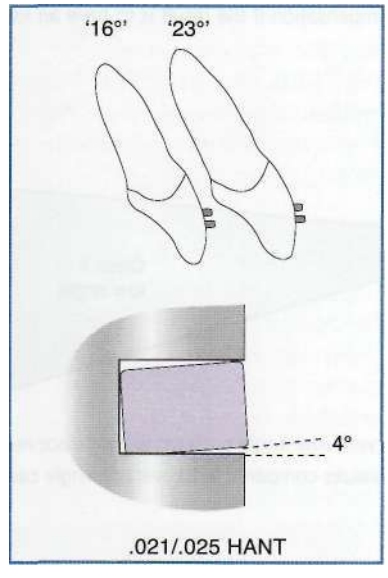


Fig. 8.19

Figs 8.18 and 8.19 The use of a heavier .021/.025 rectangular HANT wire for one or two visits in these non-extraction cases, which do not require sliding mechanics, has the effect of increasing the upper incisor torque specification by 6 degrees, due to the reduced slop.

Incisor torque compensation - A/P considerations

If there is a Class II skeletal pattern there will be a need for incisor torque compensation if the result is to have an ideal overjet and overbite. Without torque compensation there will normally be a residual overjet (Fig. 8.20).

Incisor torque compensation - vertical considerations

Likewise, the goals for torque values vary between average-angle and low-angle patterns (Fig. 8.21).

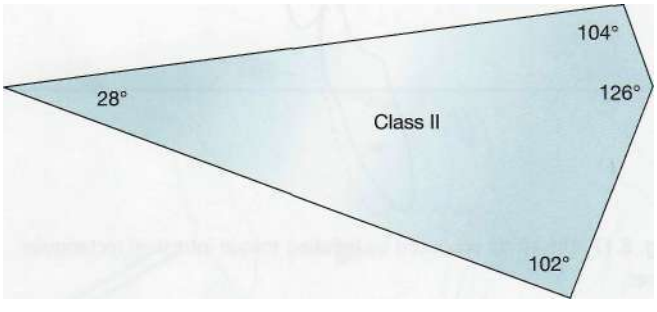


Fig. 8.20 If there is a Class II skeletal pattern there will be a need for incisor torque compensation if the result is to have an ideal overjet and overbite.

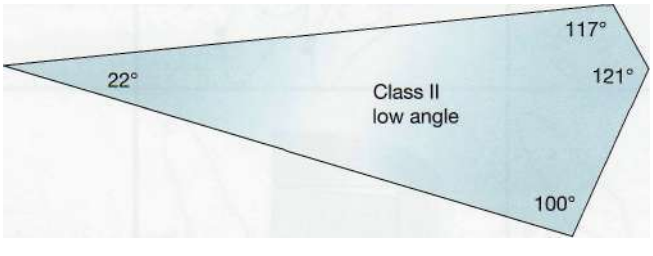


Fig. 8.21 Cases with low-angle patterns will produce results that have different torque values compared with average-angle cases.

Correction of molar torque the need for upper arch width

This is discussed in Chapter 3, but further comments are included here. During upper arch expansion molar torque changes occur, for example when using a quadhelix or other expansion appliance before the Andresen appliance. Upper molar expansion can also be seen during Andresen wear, if the appliance has guidance grooves (page 37), or if it has a built-in expansion screw or Coffin spring.

The MBT™ system has extra upper molar torque, compared with SWA, and corrects the molar torque in most cases without wire bending. This capability was increased when a 19 degree upper second molar tube became available in 2005 (Fig. 8.22). For a few cases it is necessary to add molar torque to the steel rectangular .019/.025 wire, and to expand it a little, to prevent a molar crossbite developing as the molar torque corrects. The width of the maxillary bone can be a limiting factor when attempting to correct upper molar torque (page 37).

Fig. **8.22** A 19 degree upper second molar tube became available in 2005 and provides additional torque control.

CHECKING CO/CR IN THE LATER STAGES

Some cases may appear to have an ideal occlusion as the fixed-appliance stage progresses, but careful checking may show that the condyles are slightly forward of their ideal centered positions, allowing the patient an easy and convenient bite (Fig. 8.23).

It is necessary to explain the situation to the patient, and to continue with Class II mechanics while waiting for a little more A/P correction either from growth or tooth movement. Favorable mandibular growth often occurs in these low-angle patients, especially boys.

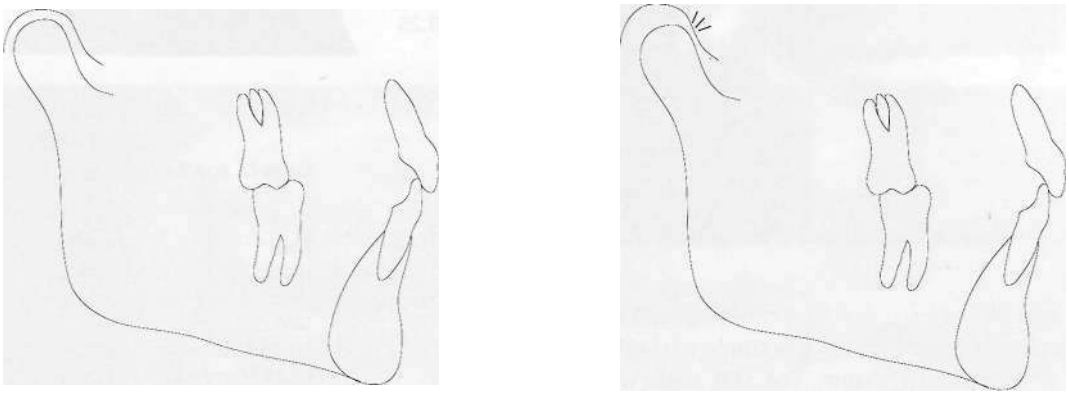


Fig. 8.23 Careful checking is needed to ensure that the patient does not have a protrusive 'bite of convenience' in the closing stages of the treatment, with the condyles slightly forward of their ideal centered positions, as shown in the right-hand part of this illustration. Ideally, the condyles will be centered in the fossae when the overjet has been corrected (left).

CASE DI

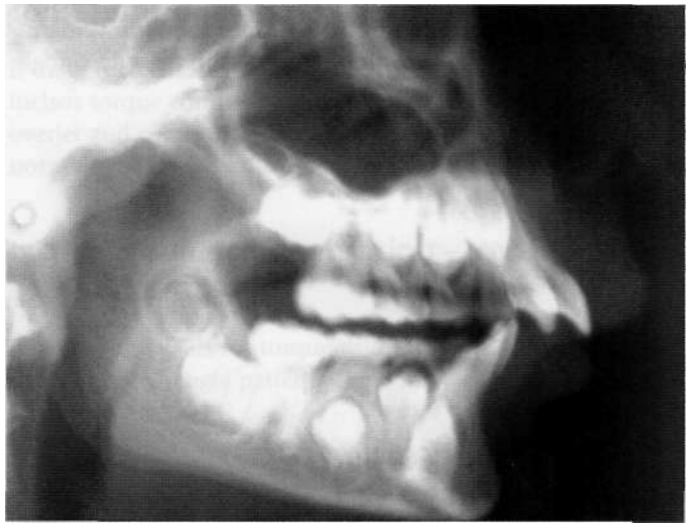


Fig. 8.24

This Egyptian boy was first seen at age 9.6 years (Figs 8.25, 8.26, & 8.27) when he presented with a low-angle Class 11/1 malocclusion and an overjet of 11.5 mm. The MM angle was only 15 degrees and the A/P skeletal pattern was extremely Class II with an ANB angle of 9 degrees and a Wits of +11 mm (Fig. 8.24 & 8.28). There was severe abnormality of lip anatomy and position, with the lower lip resting behind the upper incisors and the upper lip showing unusual thickness and bulk.

Dentally, the dentition was uncrowded, with 12 primary teeth present (Fig. 8.29), an overjet of 11.5 mm, a deep bite and an upper midline diastema of 3 mm. The upper right central incisor had a restored enamel fracture, which was not evident on the radiographs.

There was discussion about possible early treatment to reduce the overjet, but there was no history of teasing and an upper incisor had previously been fractured. So, in spite of the severity of the malocclusion, there seemed little logic in starting early in this case (Figs 8.30 & 8.31). Accordingly, the family accepted a recommendation that treatment should be delayed for approximately 2 years until the late mixed dentition.

Almost 2 years later the facial appearance continued to be typical of a severe Class II division 1 malocclusion (Figs 8.32 & 8.33). It was felt that reduction of the overjet to near-normal levels (Fig. 8.34) would allow normal development of the lips and could be expected to produce pleasing facial harmony in later life, in accordance with the original thinking of Andresen.

Fig. 8.25

Case DI age 9.6

SNA	86°
SNB	77°
ANB	9°
Wits	+ 11 mm
MM	15°
U1 to Max plane	121°
L1 to Mand plane	112°

Fig. 8.28

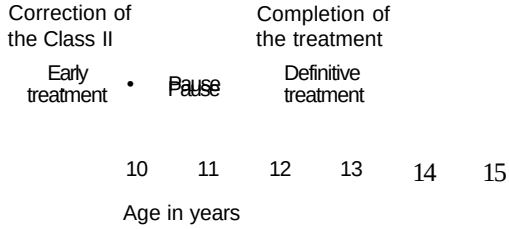


Fig. 8.30

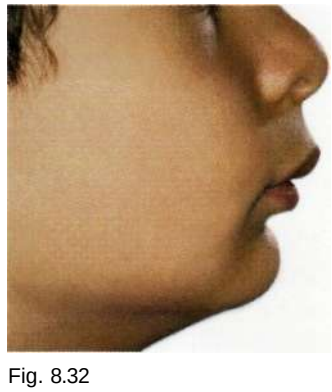


Fig. 8.32

Fig. 8.26

Fig. 8.27

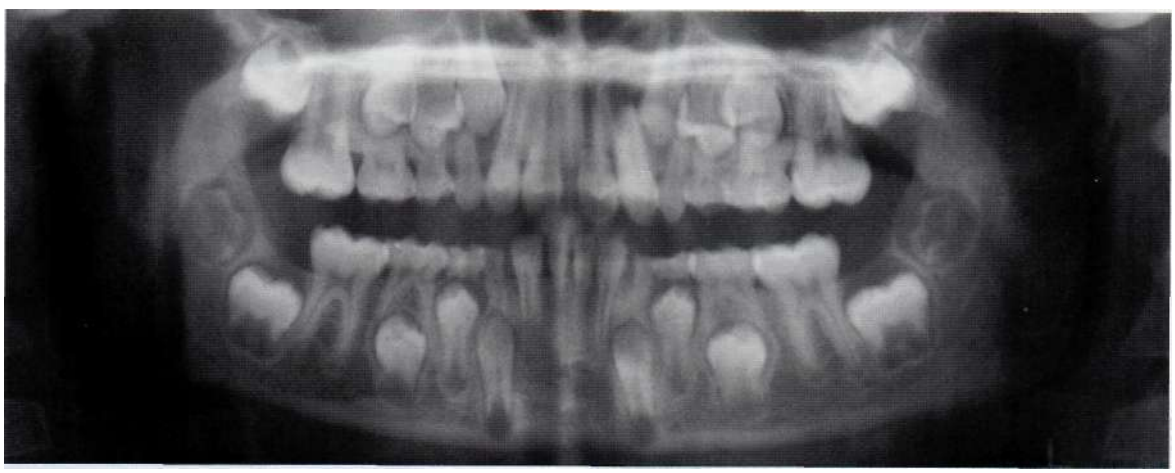


Fig. 8.29

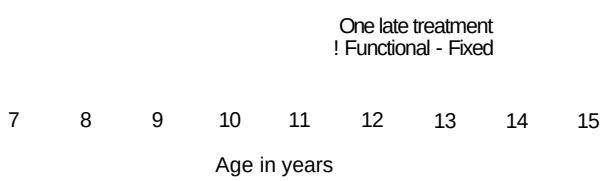


Fig. 8.31

Fig. 8.33

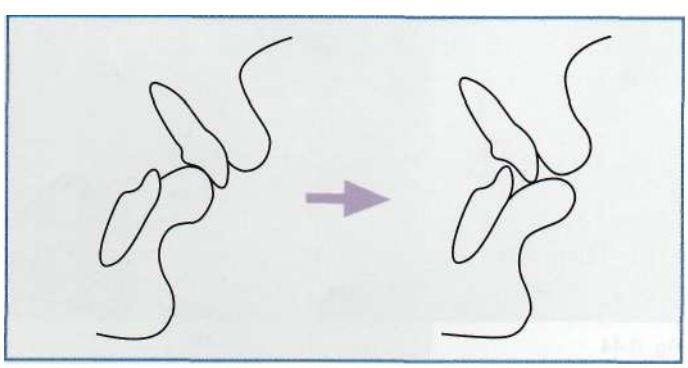


Fig. 8.34

New records were taken at age 11.4 years (Figs 8.35 to 8.37 & 8.38 to 8.42). The case was ready to commence treatment, with only two primary teeth remaining in the late mixed dentition. The severe Class II low-angle skeletal pattern was little changed (Figs 8.44 & 8.45), with disproportionate growth continuing and the overjet slightly increased to 13.0 mm.

The case was outside the recommended criteria for case selection in Chapter 3, due to the overjet of 13 mm and the ANB angle of 9 degrees. Also, compliance was expected to be less than ideal, because although the patient seemed to have a good attitude to treatment, it was felt that he may lack sufficient focus to cooperate for 24 months, and he had difficulty staying still when radiographs were taken.

However, it was decided to go ahead as planned, and use probably two Andresen appliances (Fig. 8.43) for about 9 months to reduce the overjet and allow eruption of the lower molars and premolars, with this to be followed by fixed appliances for a further 18 months. It was explained that good compliance would be essential to fully correct this tough case.

Fig. 8.35

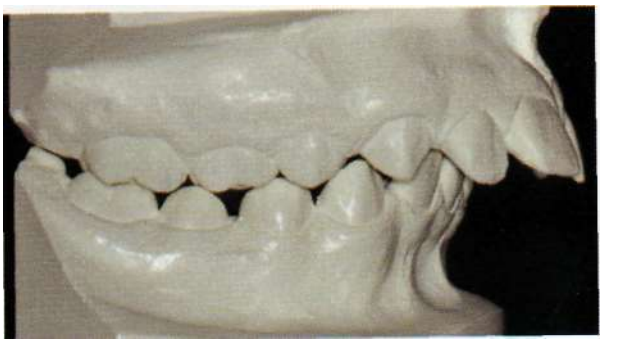


Fig. 8.38

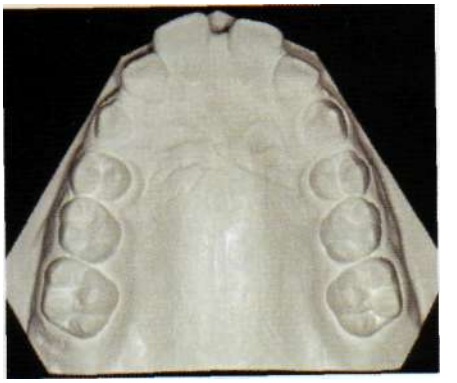


Fig. 8.41

Fig. 8.44

Case Dl age 11.5

SNA	87°
SNB	78°
ANB	9°
Wits	+ 11 mm
MM	13°
U1 to Max plane	126°
L1 to Mand plane	114°

Fig. 8.45

Fig. 8.36

Fig. 8.37

Fig. 8.39

Fig. 8.40

Fig. 8.42

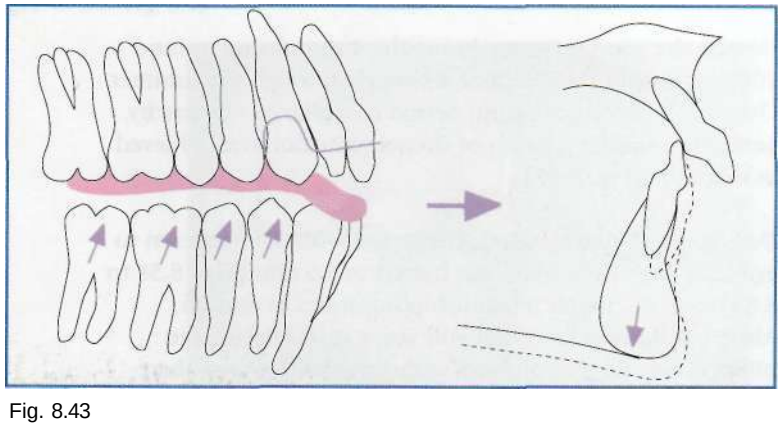


Fig. 8.43

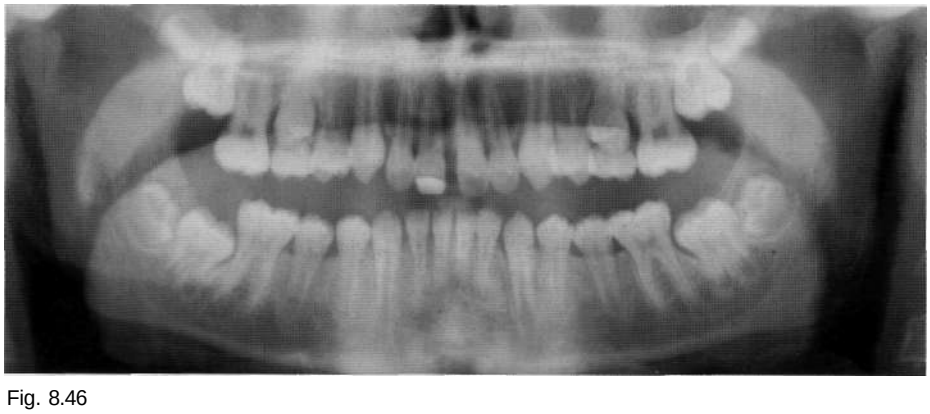


Fig. 8.46

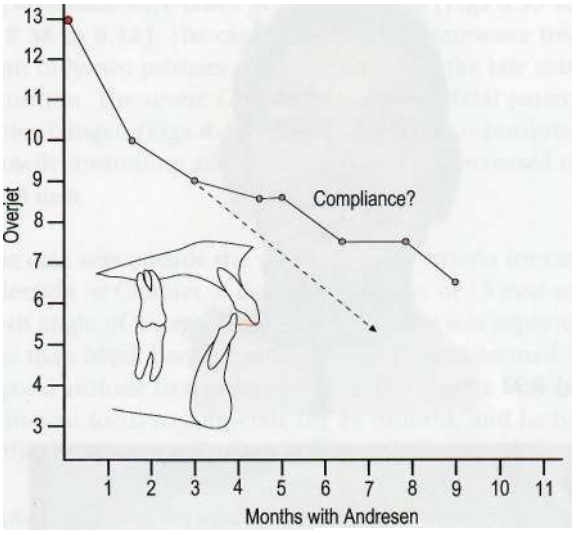


Fig. 8.47

Fig. 8.48

Fig. 8.51

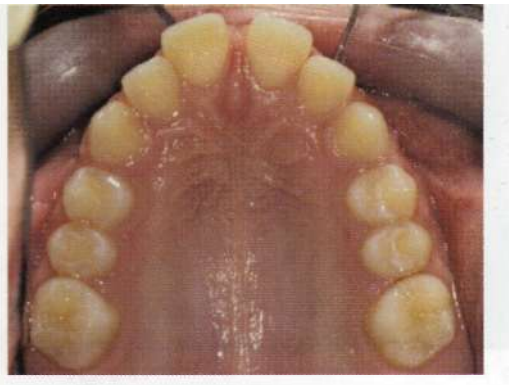


Fig. 8.54

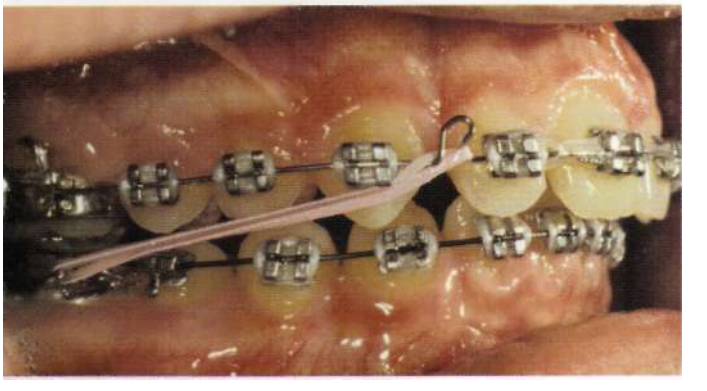


Fig. 8.57

The first Andresen was constructed using a wax bite with the mandible protruded approximately 9 mm (Fig. 8.56) and with 6 mm of opening at the incisors, to encourage an increase in lower face height. It was fitted at age 11.4 years and after 4 months of wear the overjet had reduced to 9 mm, with an associated improvement in facial appearance (Figs 8.47, 8.48, 8.49, & 8.50).

Despite the good progress during the 4 months up to June 2003, treatment then became a struggle through the summer. Over the following 5-month period compliance was patchy, and only a further 2.5 mm of overjet reduction was achieved in that time (Fig. 8.47).

During the 11-month treatment period with the Andresen to age 12.3 years the overjet was halved to 6.5 mm (Figs 8.51 to 8.55), and the molar relationship improved to end-on. Although the appliance was still active it was decided to proceed into fixed appliances without delay, because there seemed little prospect of further progress with removable functional appliances.

Full-size metal appliances were placed at age 12.4 years, and when .016 round upper and lower wires were placed at the first adjustment the patient was asked to wear light Class II elastics during the evenings and when sleeping (Figs 8.57, 8.58, & 8.59). The case went into the normal upper and lower .019/.025 steel working wires at age 12.11 years and the overjet eventually reduced to 3 mm, although cooperation with elastic wear was intermittent. Fixed appliances were in place for a total of 13 months, being removed at age 13.5 years.

Fig. 8.49

Fig. 8.50

Fig. 8.52

Fig. 8.53

Fig. 8.55

Fig. 8.56

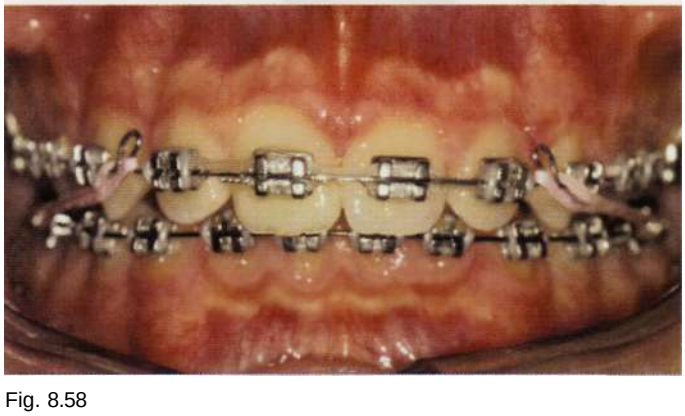


Fig. 8.58

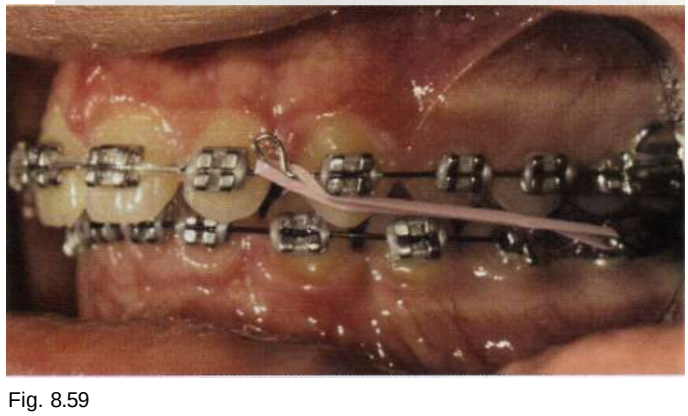


Fig. 8.59

Treatment was completed at age 13.5 years. Despite the below-average compliance, it proved possible to reach a Class I occlusion (Figs 8.63, 8.64, & 8.65) and obtain a remarkable improvement in facial harmony (Figs 8.60, 8.61, & 8.62). Total active treatment time was 24 months, but could have been less with better cooperation.

A tooth positioner was provided for 5 weeks before proceeding into normal retention at age 13.6 years. Cephalometrically the Class II skeletal pattern became almost Class I during treatment, and upper incisors retroclined to an acceptable 115 degrees. Lower incisors were unchanged compared with the pre-treatment measurement, at 114 degrees, but the bone anatomy of the anterior part of the mandible is atypical in this very low angle boy and in other similar cases, for example Case MZ (p. 120). As with Cases OD (p. 78) and MZ (p. 120) the three-quarter smile view appears to be slightly retrognathic (Fig. 8.66), confirming that headgear is not required in this type of low-angle case.

Progress with the Andresen appliance was slower than expected due to intermittent compliance. During the fixed-appliance stage tooth brushing was not good, and several key appointments were failed. Also, removable retainers were lost on two occasions. At the outset the compliance was good until the gross overjet had been corrected, after which there was a disappointing level of cooperation.

Fig. 8.69

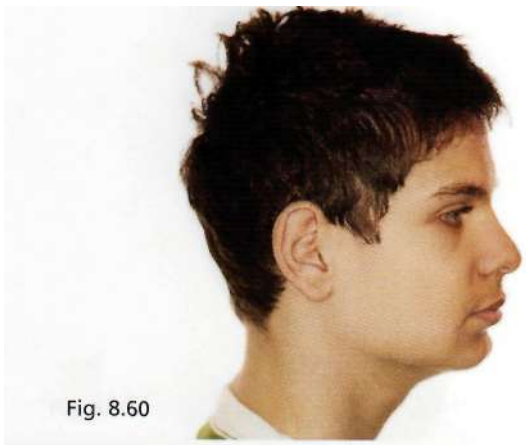


Fig. 8.60

Fig. 8.63

Fig. 8.66

CaseDI age 13.5

SNA	86°
SNB	81°
ANB	5°
Wits	+ 2mm
MM	12°
U1 to Max plane	115°
L1 to Mand plane	114°

Fig. 8.70

Fig. 8.61

Fig. 8.62

Fig. 8.64

Fig. 8.65

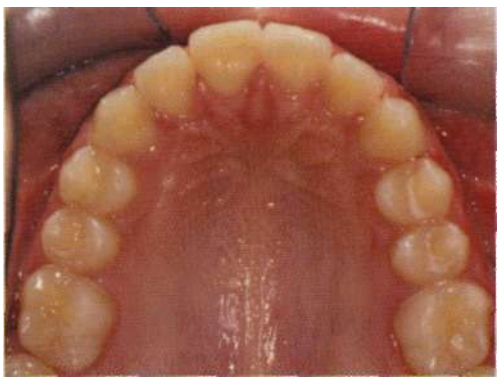


Fig. 8.67

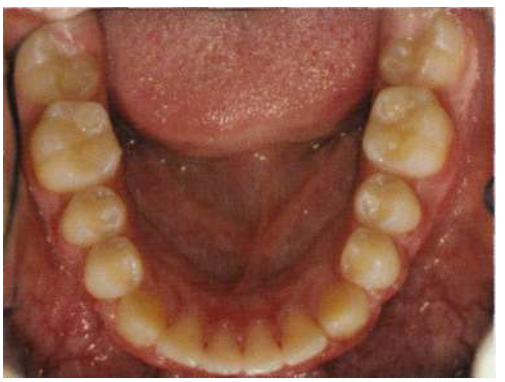


Fig. 8.68

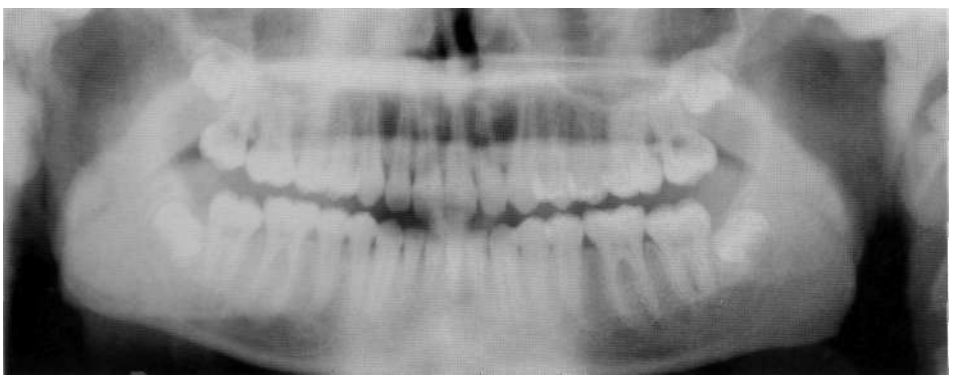


Fig. 8.71

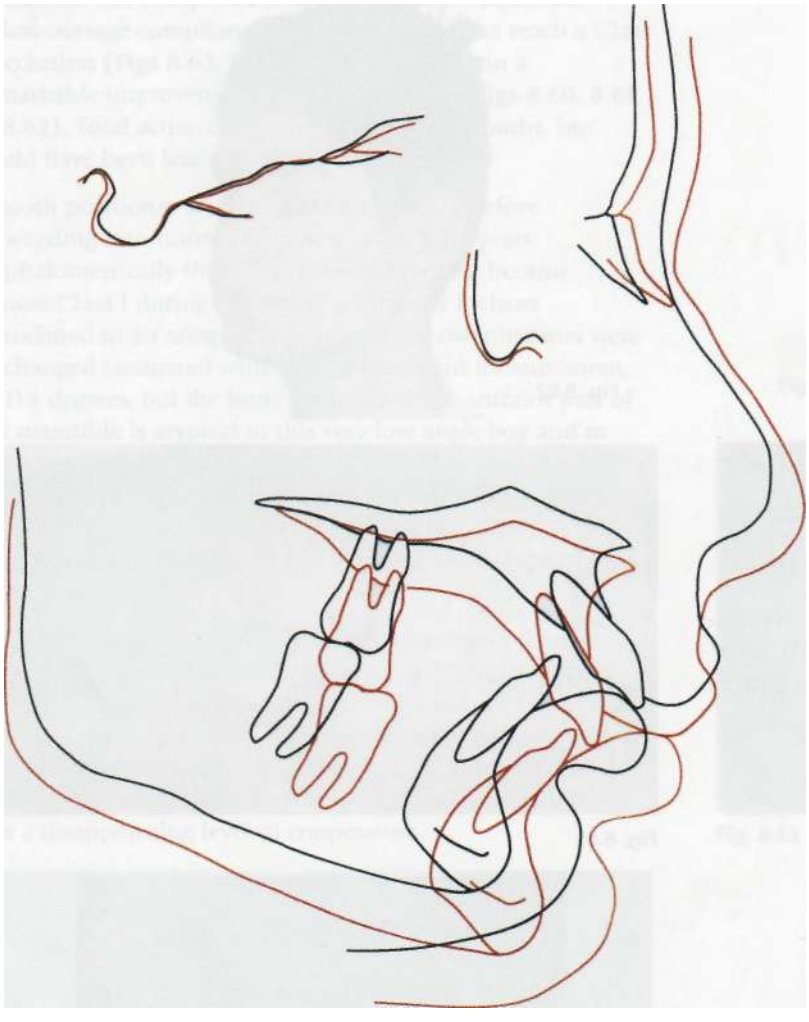


Fig. **8.72** Case DI is the most severe of the cases included in this book. The before and after tracings are shown at 80% of actual size, and are superimposed on sella-nasion line at sella. The active treatment time was 25 months, and despite patchy cooperation substantial downward and forward growth is evident, which contributed to the improvement in facial appearance. The skeletal pattern became almost Class I from a severe Class II starting situation. As with similar cases, the atypical bone anatomy and heavy bite prevented achievement of ideal lower incisor torque, which was unchanged at the starting measurement of 114 degrees.

Case DI	age 11.5	age 13.5
SNA	87°	86°
SNB	78°	81°
ANB	9°	5°
Wits	+ 11 mm	+ 2mm
MM	13°	12°
U1 to Max plane	126°	115°
L1 to Mand plane	114°	114°

REFERENCES

1 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh

2 Arnett GW, McLaughlin RP 2004 Facial and dental planning for orthodontists and oral surgeons. Mosby, Edinburgh, Chapter 7

3 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh, 174-176

CHAPTER 9

Post-treatment considerations and retention

QUESTION

Is retention difficult and what are the recommendations?

ANSWER

The cases show first-class stability. A normal lip seal is achieved with the Andresen, which tends to hold the corrected overjet, and these uncrowded cases generally have few rotations at the start, so dental stability is good also. Positioners can be helpful for a few weeks to consolidate the dental and skeletal achievements, followed by the normal Systemized Orthodontic Treatment Mechanics retention protocol.[1]

In general these cases show good stability, and a normal retention protocol can be followed.[1] Many of the cases have only minor tooth irregularity at the start of treatment, and so dental alignment tends to be stable. The soft-tissue lip seal helps to hold the corrected overjet.

Careful retention is needed for cases that were on the borderline for case selection (Chapter 3, page 27). For example, individuals with a slightly high angle pattern or a starting overjet of more than 12 mm.

THE ADVANTAGES OF TOOTH POSITIONERS

Correctly constructed tooth positioners (Fig. 9.1) can be effective immediately after removal of the fixed appliances, because they support the goals of both stages of the treatment. They maintain an ideal overjet and overbite correction in the same way as the Andresen appliance, and simultaneously produce final detailing of the individual tooth positions. They are required for only a few weeks in some cases, and can then be followed by normal retention methods.

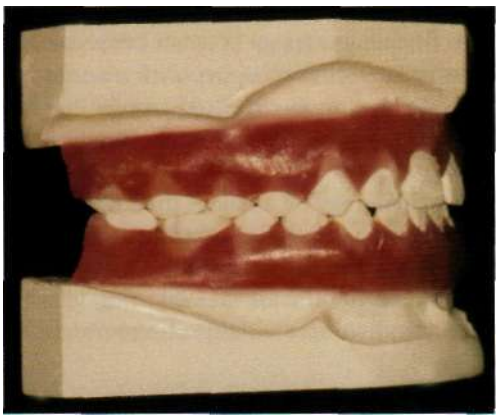


Fig. 9.1 A well-constructed tooth positioner can be effective immediately after removal of the fixed appliances, and will support the goals of both stages of the treatment. If it is over waxed this allows individual teeth to seat fully in cases with gingivitis at the end of fixed appliance treatment.

Fig. 9.2 The right side of the dentition at the time of appliance removal (CaseMZ, p. 114).

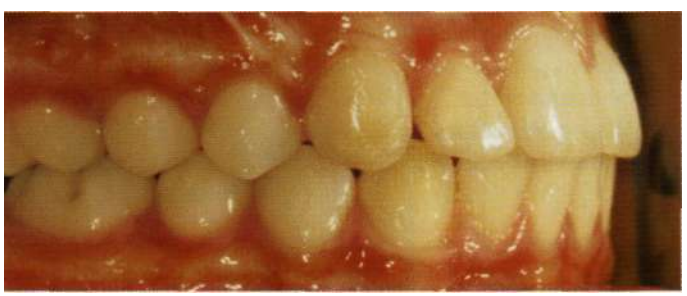


Fig. 9.3 After 3 weeks of wear during the evenings and at night the positioner has slightly improved the final detailing of the tooth positions (Case MZ) and the case can proceed into normal retention.

SOFT-TISSUE STABILITY AND LIP SEAL

During the Andresen stage the importance of the lip seal was explained to the patient (page 112), and this needs to be discussed again as retention begins, with a reminder to the patient and parents that the lip seal plays an important part in stabilizing the upper incisor position (Fig. 9.4).

In a few cases there may be a risk of the lower lip resuming abnormal function behind the upper incisors. This possibility is more frequently seen in cases with a slightly higher angle pattern,[2] on the borderline for case selection (Chapter 3, page 32), or in individuals with abnormal tongue form or function (Fig. 9.5).

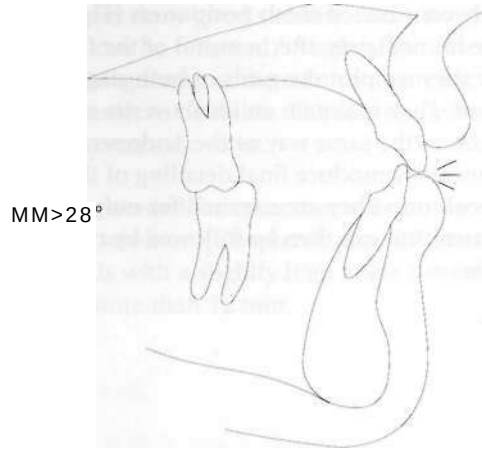


Fig. 9.5 There may be a risk of the lower lip resuming abnormal function behind the upper incisors in cases with a slightly higher angle pattern, or in individuals with abnormal tongue form or function.

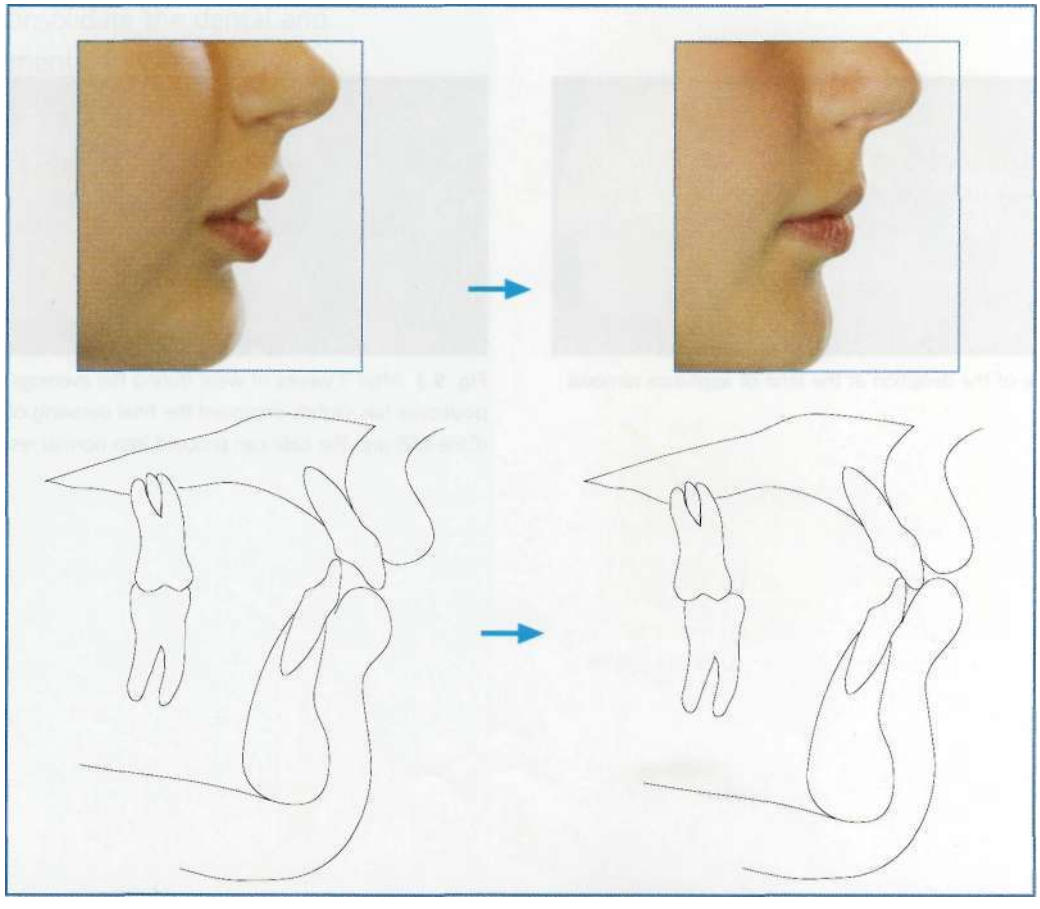


Fig. 9.4 The lip seal plays an important part in stabilizing the upper incisor position and overjet correction.

STABILITY OF TOOTH ALIGNMENT AND OVERJET REDUCTION

Case selection for this treatment method recommends individuals with uncrowded arches, and many of these are free of rotations or major dental irregularities. Accordingly, dental alignment tends to be stable after treatment. A lingual .015 multistrand bonded retainer (Fig. 9.6) is preferred for the lower anterior teeth. A vacuum-formed nocturnal retainer (Fig. 9.7) is normally used in the upper arch, although this may be preceded by a Begg type of wraparound retainer in cases where there is a need for the buccal segments to settle and where a tooth positioner has not been used.

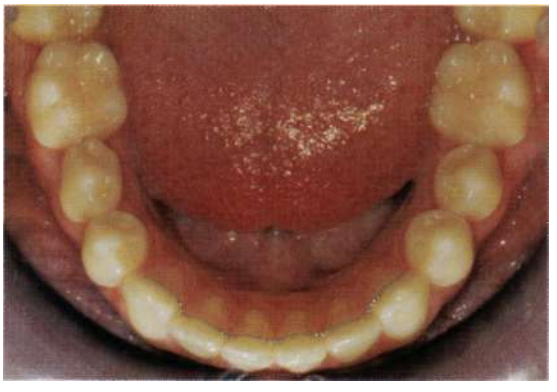


Fig. 9.6 A bonded lower retainer is routinely used in the lower arch.

Fig. 9.7 Normal upper-arch retention involves a vacuum-formed retainer worn only at night.

The improvements in facial profile are stable in most cases, because the treatment method creates a corrected soft-tissue environment for the incisors, and the lip seal normally prevents overjet relapse. However, as discussed in Chapter 3, this good stability of overjet correction is dependent on correct case selection.

In general, after any Class II division 1 treatment there is a risk of poor cooperation with retention, the return of a digit sucking activity, or condylar remodeling,[3] and any of these can lead to an increased overjet after treatment.

Most patients are about 14 years old at the end of active treatment. If there was Class II growth before treatment, in theory unfavorable growth can continue during the retention phase (page 30). This is more of an issue with girls than with boys, and in individual cases it can be unclear whether growth issues are involved, or the early signs of condylar remodeling. For a few Class 11/1 female patients condylar remodeling occurs during or after orthodontic correction, and is a major concern in orthodontics.

During case selection there may be signs that the condylar anatomy is not ideal and therefore unable to support the position of the mandible after correction of a big overjet.[4] Thus, if a case is selected for Andresen/fixed treatment with an overjet which is greater than 11 mm, it may be possible to achieve full correction, but stability may be a problem later on due to condylar remodeling.

MANAGING DIFFERENCES IN TREATMENT OUTCOME

Cases with an ideal outcome

Many cases will proceed uneventfully towards an ideal result. As treatment comes to an end it is important not to remove the fixed appliances too early. Subtle and favorable tooth movement can often occur if the fixed appliances are merely retied for a further 3 months after the case seems to be completed.

A tooth positioner can be helpful in even the ideal cases before going into the normal retention protocol.[1] When presenting the retention protocol to the patient and parent, it is helpful to have the starting records available, because it is easy for the family to forget the severity of the original problem. A quick review of the starting models, photos and cephalometric radiograph provide a useful reminder of how much has been achieved, and this re-enforces the need for proper retention.

Cases heading for a good, but not ideal, outcome

Towards the end of treatment these can be discussed with the patient and the family. In cases that have run out of growth and/or cooperation, the family may request that appliances be removed, and the near-to-ideal result be accepted. However, it can be helpful to suggest: 'Why don't we take off the fixed appliances and use a positioner for a month or two?'. Many children will provide a final burst of cooperation with a positioner in return for having the fixed appliances removed.

REFERENCES

1 McLaughlin RP, Bennett JC, Trevisi HJ 2001 Systemized orthodontic treatment mechanics. Mosby, Edinburgh, Chapter 11

2 Pancherz H 1979 The mandibular plane angle in activator treatment. Angle Orthodontist 49:11-20

3 Arnett GW, McLaughlin RP 2004 Facial and dental planning for orthodontists and oral surgeons. Mosby, Edinburgh, 141

4 Arnett GW, McLaughlin RP 2004 Facial and dental planning for orthodontists and oral surgeons. Mosby, Edinburgh, 145

Index

C

D

N

O

P

CL

R

S

T

V

W