TRENDS IN ACTIVATOR DESIGN AND USE FOR CLASS II DIVISION I MALOCCLUSION

A thesis embodying original work, submitted in partial fulfillment of the requirements for the Degree of Master of Dental Science in the Faculty of Dentistry, University of Sydney.

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The cheerful humanitarian experiences from which I have benefited will remain precious to me for ever.

CONTENTS

INTRODUCTION

The recent English language literature relating to activator therapy has been reviewed for the purpose of identifying developments from the early work of Andresen and Haupl. The review is limited to the clinical application of the method.

Some divergent trends have been identified and will be discussed.

The original work presented is the author's attempt to provide a suitable combination of appliances and method appropriate to our present state of knowledge in this field.

Practising orthodontists rely mainly on visual interpretation of their results. It is for this reason that the results of the cases reported are presented as before and after photographs and as life-sized superimposed tracings of before and after lateral plate radiographs.

Some measurements have been made to assist in the evaluation of the changes produced.

LITERATURE REVIEW

1. The Early Work of Andresen and Haupl

The preface of the 1952 "Textbook of Functional Jaw Orthodaedics" by Haupl, Grossman and Clarkson states that it presents an "up to date view of the theoretical basis and practical aspects of functional orthodontic therapy". It may well be that by 1952 changes from the original Andresen Haupl methods had occurred. The difficulties and costs of obtaining and translating the earlier literature prohibits its inclusion in this review. Haupl, Grossman and Clarkson (1952) (p. 195) state that the appliance should be worn "without fail every night". In addition to this, the patient should be instructed to wear it "for one or two hours during daytime, but it must not be worn at meals or at school or play". They say also that "it is expedient for the child to accustom itself to wearing the appliance while speaking since its efficacy depends on activation".

It is further pointed out that the appliance may fall out of the mouth until the child has become accustomed to it. Wearing it for an hour before sleeping is suggested as a way to overcome this. Nasal obstruction is mentioned as one cause of serious difficulty in having the appliance accepted. The appliance must fit well and be observed first after two weeks and then monthly for adjustments and patient encouragement. The patient must be instructed to return immediately if there is pain or discomfort.

Success must be explained and represented as being due to the child's cooperation. A defective appliance must be immediately adjusted or replaced.

Haupl, Grossman and Clarkson continue by claiming that changes will usually be seen after eight weeks, and occasionally after four.

The Haupl, Grossman, Clarkson text discusses paradontal and articular tissue changes in relation to activator therapy. Paradontal tissue changes involve changes to the tissue surrounding the teeth. Much of the earlier work concerning periodontal membrane response is reviewed. Articular changes concern the temporo-mandibular joint. The sometimes conflicting results of work by Breitner, Haupl, Psansky and Kingsley are referred to. The text offers the conclusion that "Clinical experience has shown that articular transformations may be obtained very easily and relatively rapidly, even in the youthful permanent dentition by the use of purely functional methods."

Occlusal changes are checked with the head vertical. If there are no changes after 2 - 3 months it is usually because the appliance is not being worn. Nasal obstruction may be the cause. If there is no change after 3 - 4 months it "is a sign that the treatment necessary will not be easy". One appliance is usually used for about one year when it may need replacement. Following active treatment, retention with reduced wearing time is necessary, and observation should be maintained, at least until eruption of the

second molars and canines.

What is meant when night time wear is written about is often not clear. My understanding, from inference only, is that Haupl, Grossman and Clarkson consider night time to be time spent in bed and not the hours of darkness. The vagueness of reports of instructions given to patients, compounded by the variability of patient cooperation makes the determination of actual wearing time of many of the reported cases difficult or impossible.

Analysis of the cases presented in the Haupl, Grossman, Clarkson text reveal some treatment durations. Case Prague 8 required three and one half years and four appliances with night only wear, to treat a very narrow upper arch and severe disto-occlusion. Case Prague 776 aged 14 years, described as dysgnathic with narrow dental arch and upper protrusion deep overbite and disto-occlusion was treated in 16 months with two appliances. Upper arch expansion was involved in both these cases.

The authors comments about case Prague 776 is, "in addition to ready cooperation of this patient, favourable tissue reaction to the transforming stimuli was responsible for obtaining such a result in so short a time".

The range of treatment times for the cases presented was from 16 months to 54 months. It is not stated if these treatment times include retention as discussed on page 198 of the text.

The report and 61 references by Gresham in 1952 provides an excellent concise review of some of the early activator literature. One of Gresham's conclusions was that the rest position, and the occlusal position of the mandible in Angle class II malocclusions are capable of alteration. After treating twenty patients aged 6 to 16 years for an average treatment duration of 12 months, and taking 471 cephalometric and 134 temporomandibular joint radiographs another of his conclusions was that treatment causes the condyles to first occupy a position forward of their original position. They then grow upwards in relation to the cranium during treatment. This point is important in any consideration of how an activator works. Does the forward positioning of the mandible depend on condylar growth or is any additional upward growth of the condyles a secondary result of the mandible becoming reestablished in a forward position? In cases where treatment extends over several years both events may occur together. If mandibular relocation could be achieved in months instead of years it may be argued that any additional condylar growth - if it occurs - is a secondary effect. Woodside (1973) however, has found that no additional mandibular length or growth velocity resulted from activator use in a study to age 17 years using a control group for comparison.

2. 1960 - 70

The example given by Schwarz (1966), using an Andresen-Haupl type activator required 16 months to achieve most of the correction. A second appliance with an expansion screw was used for a further 27 months including retention to achieve what appears to be a completely acceptable result. The appliances were used at night only.

The 1965 British Symposium on Functional Therapy is a useful reference concerning the use of activators in England at that time. The symposium covered an analysis of one consecutive series of 100 cases, other case presentations, appliance design and appliance selection. There was also a panel discussion by prominent British orthodontists with Robert Moyers contributing an American viewpoint. Dickson's 100 cases were Class II, Division I, types. The average duration of treatment time for successful cases was 15 months with a range of from 5 to 48 months. Dickson's patients used appliances which routinely incorporated a centreline Coffin spring. Wearing time was while in bed, and for one hour before retiring.

At that symposium Grossman (1965) stated that his working bite method differed from the Andresen-Haupl method in that he brought the mandible forward into neutro-occlusion in one step, but only if preparatory orthodontic movements were not required. By this I think he refers to the need to first move any individual or groups of teeth to a position allowing

occlusal harmony without cuspal interferences in the anticipated neutro-occlusion position of the mandibular arch. In short, necessary paradontal changes should precede articular changes.

Mills (1965) presented 5 unselected cases with duration of treatment excluding retention of from 11 to 28 months. Records 2 to 4 years out of retention showed acceptable results. Mills stated of the activator; "I find it the appliance of choice in one rather uncommon type of Class II Division I malocclusion". All the panel members requested bed-time wear and some advised including an hour before bed-time.

Grossman and Moss (1965) reported 2 Class II Division I cases, one of which required upper arch expansion. They required 23 months and 24 months of treatment.

Rix (1966) described a number of modifications to the Andresen-Haupl appliance. Some of them are important in any consideration of wearing times. The anterior palatal area was removed for the Rix modification and the lower anterior teeth capped with acrylic. This aids speech, breathing and avoids the necessity of reducing the anterior palatal area as the upper incisors are retracted. The capping of the lower anteriors helps control forward tipping of the lower incisor teeth. The Rix method of trimming around the lower buccal teeth differs from that of Andresen and Haupl and leads on to the later methods of Harvold and Vargervik (1971). The cases presented

by Rix (1966) were mainly late mixed dentition with a reported treatment duration of 24 to 36 months. Some were complicated by extractions.

3. 1970 -

Tulley(1972) has explained how Robin in 1902 used a monobloc appliance to hold the mandible forward independent of the teeth. It is interesting that this idea is used in some of the second generation activators currently in use. Tulley(1972) also discussed other historical aspects of the development of activators.

The six cases presented by Tulley(1972) had treatment duration ranging from 21 to 36 months. Some were extraction cases. The wearing instruction was night only plus extra evening wear if possible.

Valinoti (1973) presented 2 cases in a paper on the subject. One case used an activator for 3 months following rapid maxillary expansion. High pull head-gear and later a fixed appliance was used. The second case used two activator over 7½ months to change a Class II to a Class I molar relationship. The daily wearing time was not stated.

Jorgensen (1974) reported his total treatment time as from 2 to 3 years. His case showed an improvement after a "few months" and sometimes developed a dual bite. After 6 months distal positioning was no longer possible. Jorgensen makes moderate overjet correction with the first appliance. A second appliance is used for further correction. Wearing times are not stated.

Hirzel and Grewe (1974) describe two stages of treatment. The first is a dental change involving mainly the incisors. This took 9 months in the example presented. The second change they describe as the skeletal reaction and results in the molars becoming Class I related after 36 months of treatment. No retention was used and the result was stable three years later. They describe this case as representing their ideal activator treatment. A second case described as not meeting all of their indicated requirements needed 42 months of treatment. Daily wearing time was not described.

Demisch (1972) presented a series of 28 consecutive cases of full Class II molar relationship treatments. This was the only criterion requirement for selection. 24 of the 28 cases achieved normal relationships of the dental arches entirely by activation therapy. Demisch (1972) used the methods of Herren (1972) which differ from those of Andresen and Haupl. The differences are an overcompensated working-bite relationship and the use of clasps on the buccal teeth to hold the appliance in place. A retention appliance is used with a less pronounced over-correction of the working bite. The mean active treatment time was 13.9 months with the range from 5 to 28 months exclusive of retention. Demisch (1972) believes that successful treatment is independent of the pubertal growth spurt. The occlusal changes were similar in the 24 successful cases, but the

responses of the maxilla and mandible were often different. The upper molars often showed no forward movement during treatment. The lower molars were moved forward. Demisch (1972) uses the nomenclature of Moffet (1971) when he describes the effect produced as the sum of the responses of the periodontal, sutural and temporo-mandibular joints. No reasons were given for the cases that failed. Demisch claimed 8 of the cases showed an accelerated increase in mandibular length within the treatment time. The other 16 cases showed no such increase.

The Bionator appliance is one of the second generation activators. The principles are similar but the bulk has been very much reduced. Because of this, the appliance may be more acceptable for full time wear. Witt and Meyer (1972) described its advantages. They claimed that molar correction could be achieved in 2 - 3 months especially in horizontal growth types, if the appliance was used full-time. Buccal open bites are produced, and they state that the muscularly conditioned and repositioned mandible must be retained in its new position until growth, bone remodeling, and closure of the buccal open bite make the relationship stable.

Herren et al (1972) describe the change from Class II to cusp-to-cusp molars as taking 1 - 3 months. A further 10 - 12 months was required to achieve a Class I relationship.

A series of 37 Class II Division I cases having

neither contractions or space shortages, was presented by Ahlgren (1972). The working bite was opened 2 mm and protruded 5 mm from rest. Andresen Haupl type appliances were used.

The treatment duration ranged from 12 to 96 months with a mean of 38 months. Ten cases were changed to fixed appliances and 2 were discontinued. Four reasons given for lack of success were: poor cooperation, oropharyngeal irration, unfavourable sleeping position, and unfavourable growth period or pattern. The patients had been instructed to wear the appliance 1 - 2 hours daily, and during the whole night.

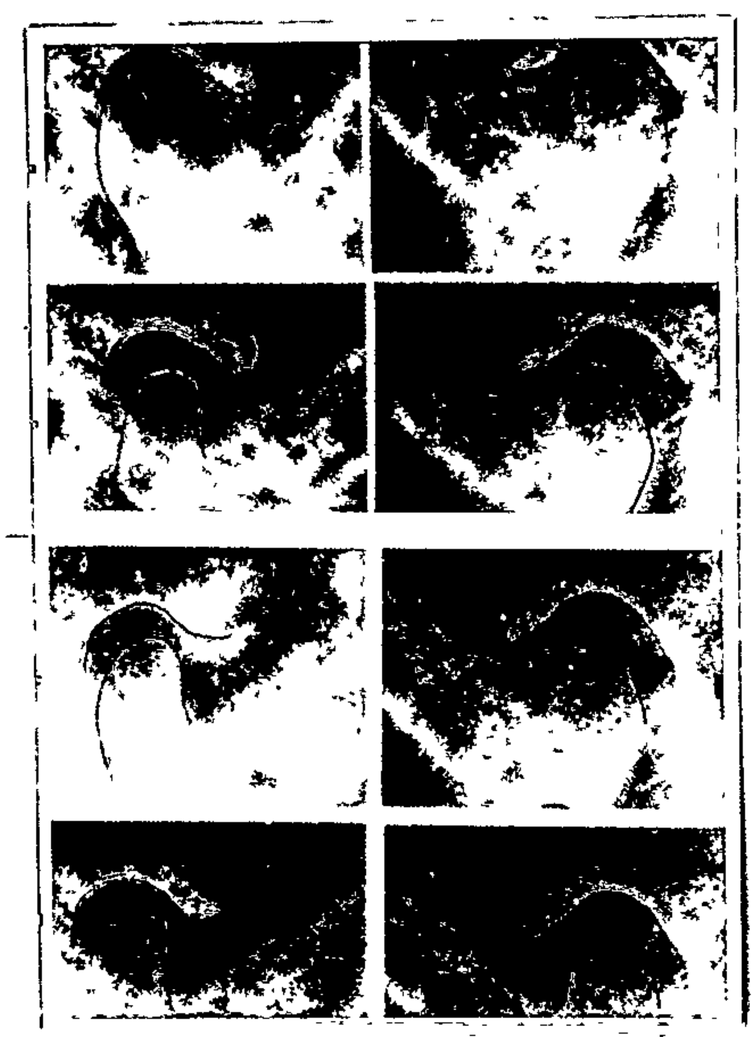
The importance of the sleeping posture and the timing of treatment to coincide with pubertal growth is stressed.

In 1970 Ahlgren discussed the action of the activator during different levels of sleep. His conclusions were that continuous pressure from stretched jaw muscles was more important than the myoclonic twitches giving rise to the intermittent forces, as originally proposed by Andresen and Haupl.

In 1973 Witt made electromyographic examination and analysis of the effect of various functional appliances. The conclusion was that re-orientation of the musculature occurs faster and to a greater extent with the full time wear design activators than with the classical type.

Reichborn-Kjennerud presented a case in 1973 which it was claimed showed "nearly all the alterations

following activator therapy". Three months treatment produced neutro-occlusion which could be forced into disto-occlusion. Six months treatment produced a neutro-occlusion which could not be forced into disto-occlusion. After 18 months the buccal occlusion was interdigitating and the treatment was finished. Six years later without further retention the results had not changed. The daily wearing time was not stated. A series of T.M.J. radiographs of the case was presented which showed the final condylar position similar to that of the working bite and forward of the original position.



A conflicting conclusion was presented by Stockli and Dietrich (1973) following a study of 25 Class II activator cases. Their opinion was that no relocation

of the mandible in a forward position occured, even though the molar relationship had been altered from Class II to Class I. The average treatment time of the series was 18 months. The daily wearing time was not stated. Retention time was not mentioned.

Woodside (1975) has concluded that both wide vertical opening and small vertical opening activators are effective in restricting the forward development of the midface. The wide vertical opening activators caused downward displacement of the midface at subnasale. He found no increase in total mandibular length resulting from treatment.

The opinion of Mills (1975) was that he could not produce skeletal changes. He said his results were similar to those produced with intermaxillary elastics and effective in reducing overjets by tipping proclined upper incisors.

The simultaneous use of cervical traction and an activator has been reported by Pfeiffer and Grobety. (1975) The example case presented required 19 months to change Class II molars to a Class I relationship. Evaluation of a series of 39 cases showed that the A.N.B. angle was halved in 18 months of treatment. Daily wearing times were, activator 12 hours per day and E.O.T. 14 hours per day. They claimed that the condyles maintained a distal position.

Benbow (1976) is experimenting with similar combinations of activator and E.O.T.

The Frankel Regulator (1971, 1975) is one of the more radical modifications of the Andresen Haupl appliance. This appliance repositions the mandible without contacting the mandibular teeth. Frankel states "as a rule the change of functional position from post-normal to normal relationship is established after about 7 months of treatment .... After that time the patient is unable to retrude the mandible into the former post-normal relationship. In this stage of treatment a distinct interocclusal clearance is always observed". The cases presented used the appliance for 1 to 2 years full-time, followed by a night retention period. Frankel therefore, also finds it necessary to use the appliance for a much longer time than that required to produce the initial neutro-occlusion.

The Frankel appliances - there are a variety to suit different malocclusions - have been designed to allow full-time wear. Frankel (1974) claims the appliance also stimulates alveolar expansion. Jenkins (1977) suggested that this expansion may be due to stretching of the periosteum of the buccal sulcus. One case treated by Frankel and reported by Newmann (1975) showed 10 mm of mandibular arch expansion due to altered cheek-tongue function. Another case reported by Frankel and Newman showed 5 mm of apical base expansion in the maxillary premolar region. This was attributed to a combination of tongue function and appliance expansion.

These features are an improvement of the Andresen-Haupl appliance. Disadvantages seem to be the risk of distortion of the appliance and the complexity of fabrication.

Adams (1975) has referred to the use of functional appliances for the treatment of post-normal occlusions in the mixed dentition but seems to often favour delaying treatment and using fixed appliances later. If treatment is started early he points out the need to maintain supervision, and, if necessary retention until the eruption of the premolars and second molars.

Hotz (1974) has described a variety of functional appliances and combinations of appliances to suit different types of post-normal occlusions at different ages. Treatment duration and wearing times varied considerably. He also makes the point about the importance of maintaining supervision, and/or retention, until the eruption of the bicuspids and second molars. Hotz believes that stimulation of mandibular growth has not been proven. He believes the important effect of functional appliances is to allow the full utilization of whatever growth potential is present.

Moss (1975) has recently compared the activity of the masseter and temporalis muscles of cases treated with functional appliances and by the Begg method. Comparisons were also made with normal occlusions. His example Class II Division I case treated with a night only activator required 23 months to change a

severe disto-occlusion to neutro-occlusion. One interesting finding of this study was that the muscle patterns of functional appliance cases after treatment were similar to the activity patterns of adults with normal occlusions. The muscle activity pattern of cases treated with the Begg method was less than half that of the functionally treated group and also had poor correlation. Moss did point out that there were other differences between the two groups of cases.

Harvold's textbook (1974) provides a comprehensive description of the methods advocated by one of the current leading clinicians and researchers in the area of functional appliance therapy.

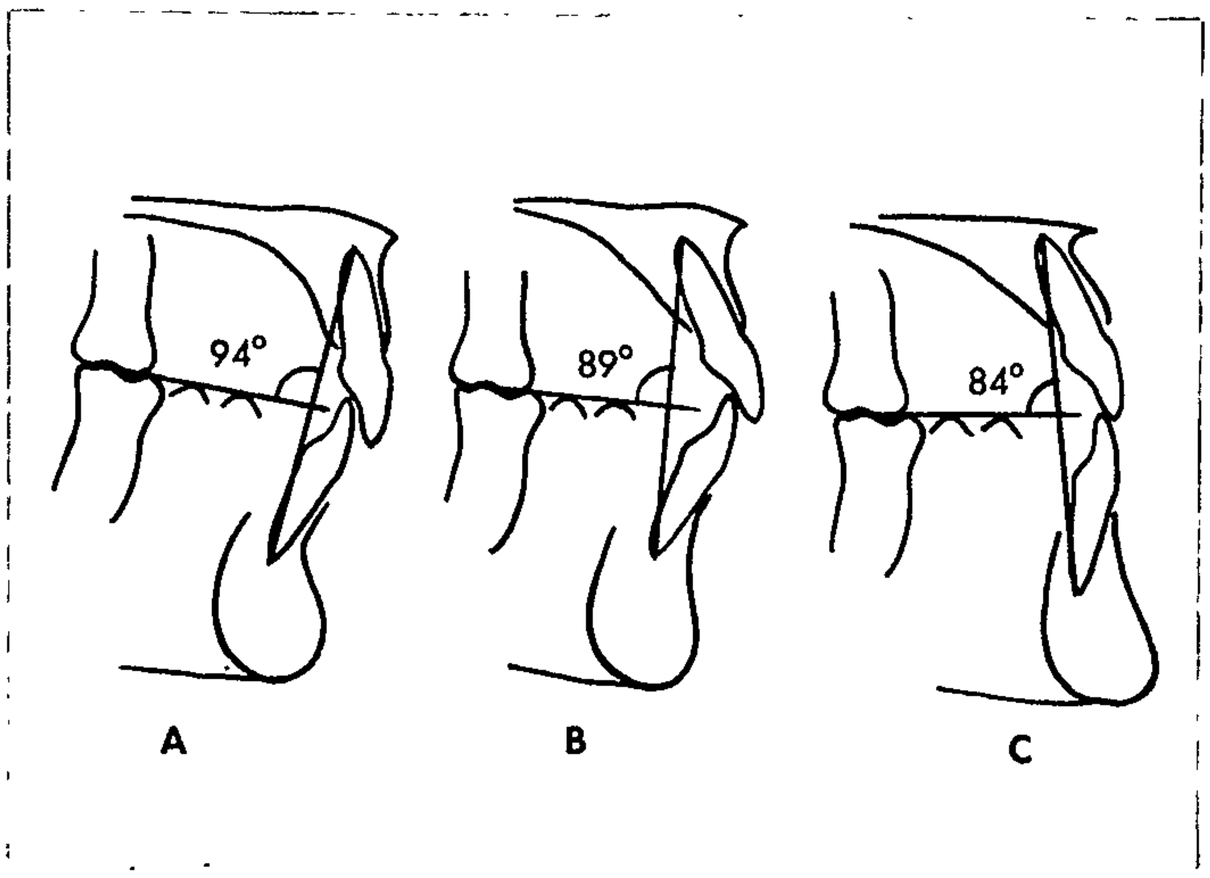
In the Preface, Harvold differentiates between interceptive and symptomatic treatment. His goals for interceptive orthodontics are:

1. "To eliminate conditions that produce malocclusions;
2. To minimize the developing dentitions response to detrimental etiologic factors".

He describes symptomatic treatment as being "focused on effects rather than causes" whereas "successful interceptive treatment is predicted on a knowledge of the potentials of an evolving biodynamic system and the limitations to which the system can be externally modified. The predominant purpose is the establishment of harmonious dental arches in an ideal interarch relation. Interceptive treatment in the transitional dentition may sometimes create a desirable occlusion. The position of individual teeth

within the arches involves other factors that are accessible to correctional treatment when the permanent dentition has fully erupted. Hence the clinician should also be skilful in the use of the traditional appliances which are more effective than the activator for precise tooth movement".

Harvold presents details of 10 cases. The arch relationships are described in accordance with his functional Class I, Class II and Class III system. This system is based on differing angles made by the occlusal plane and a line joining the apices of the upper and lower central incisors.



The Harvold Method of Cephalometric Comparison.

This system is appropriate for Harvold's methods which place considerable emphasis on encouraging eruption of lower buccal teeth while restricting the eruption and

forward movement of upper buccal teeth.

I believe Harvold has made a considerable contribution both to biologic concepts of activator design and to a clarification of the role of activator use in current orthodontic mechanotherapy. The disto-occlusion cases presented, required from 18 to 30 months of activator use including retention. Some of the cases were treated with activators only. Others required additional fixed appliance therapy.

A recent case report by Gates (1976) described how an activator was successfully used preceding a fixed appliance, for the treatment of a Class II, Division I malocclusion.

4. Appliance Design

Activators with Active Elements

The use of activators with additional active elements for arch expansion or individual tooth movements is not within the scope of this thesis. Present thinking - Harvold (1974) Adams (1975) - is that if this type of treatment is indicated, the case is best treated with fixed appliances. However, much has been written concerning the use of the activator for cases where precise tooth movements and even extractions are indicated. (Hotz 1974, Schwarz and Gratzinger 1966, Tulley 1972).

Functional Activators

Since 1952, a variety of working bite positions of the mandible have been reported. (Grossman 1965, Woodside 1970, Herren 1972, Jorgensen 1974, Harvold 1974).

The variations have ranged from less than neutro-occlusion to forced protrusion, and with bite openings from 2 mm to 18 mm. All types are reported to produce desirable results. The variations in design have been made in an effort to produce the required occlusal changes with greater efficiency, and, for some of the designs, with less stress on the patient.

Electromyographic studies of Ahlgren (1970), have not supported Andresen's original myoclonic twitch theory. Working bite openings and protrusions have been made more extreme to obtain increased forces from

the stretched muscles.

In 1966, Rix described several modifications he had found useful. These were:

1. The removal of the anterior palatal acrylic to aid speech, breathing and the retraction of the upper incisors.
2. The capping of the lower incisors to reduce forward tipping of those teeth.
3. Additional trimming around the lower buccal teeth.
4. Wire spurs to retract the upper canines.

Woodside (1970) and Harvold and Vargervik (1971) have claimed that preferential forward eruption of lower buccal teeth and restriction of forward eruption of upper buccal teeth contributes to the correction of Class II buccal occlusal relationships. This idea is incorporated in their design by allowing the lower buccal teeth to remain free of acrylic contact.

Harvold (1974) is of the opinion that mouth breathers should be encouraged to become nose breathers. For this reason he has no airway in his appliance. If the patient is unable to cope he sometimes makes a small anterior air hole.

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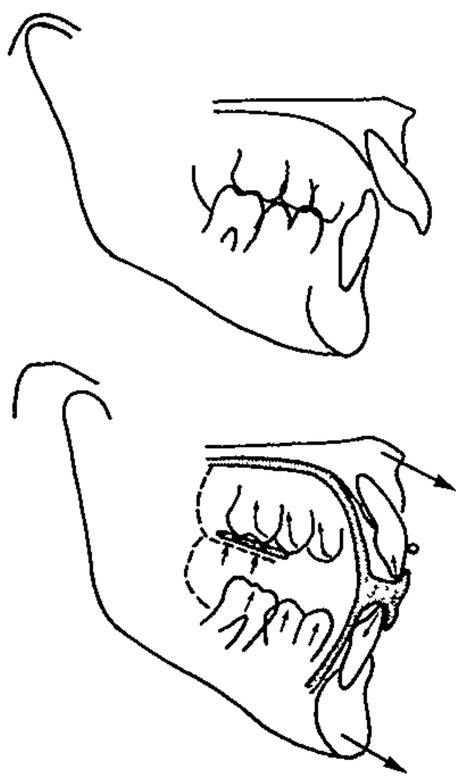
THE WORKING BITE FOR CLASS II, MONOBLOC



DGW/71

The Harvold Woodside Activator

Woodside (1970) and Harvold and Vargervik (1971) advocate maximum extension of the mandibular lingual flanges into sublingual undercut areas. This requires a final forward and downward insertion path and is said to aid retention of the appliance. A dislodging spring against the upper molars is also used by these clinicians. It's purpose, as stated by Woodside, is to "apply an undermining force to the molars and intermittently dislodge the appliance from close contact with the teeth". (1970 Toronto Notes). The reason for this, according to Jenkins (1977) is to encourage the patient to chew on the appliance and

thus stimulate muscular activity and lip competence.

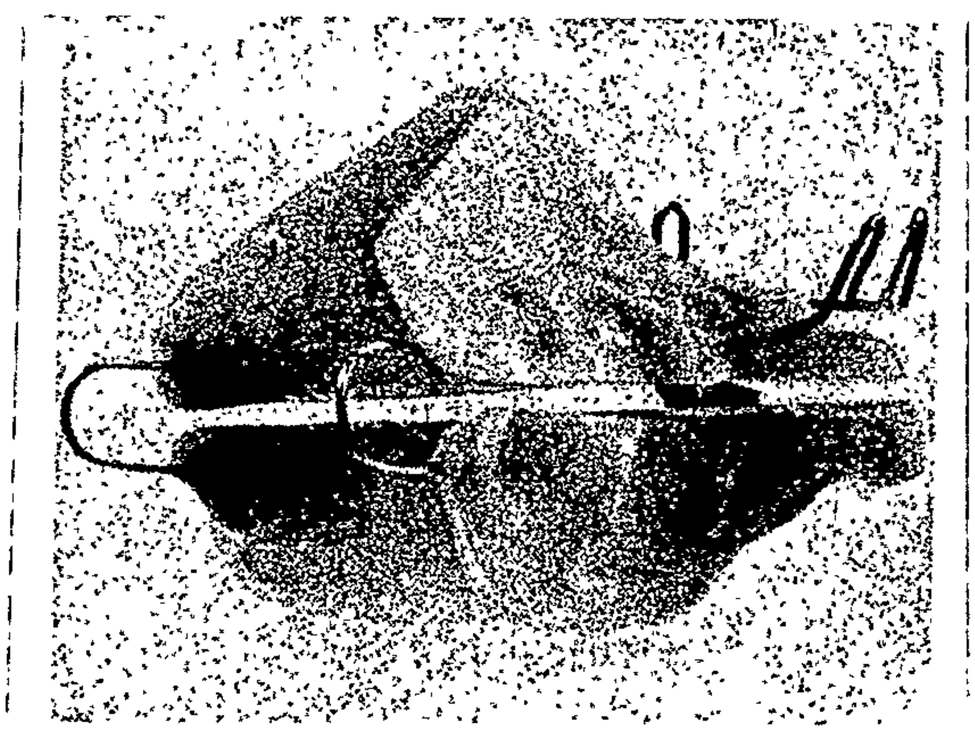
In 1972, Herren described the use of clasps on upper teeth to help retention of the appliance.

The Herren Activator

It may be that greater forces are produced by the more extreme working bite positions. Clinicians who use these exaggerated working bite positions have found it necessary to increase the retention design factors of the appliance. Acceptability of the appliance in terms of comfort and retention is of first priority. An appliance not worn is useless. A study relating appliance acceptability to various working bite relationships is needed.

Many of the more recent functional appliances are no longer similar in appearance to the Andresen-Haupl original.

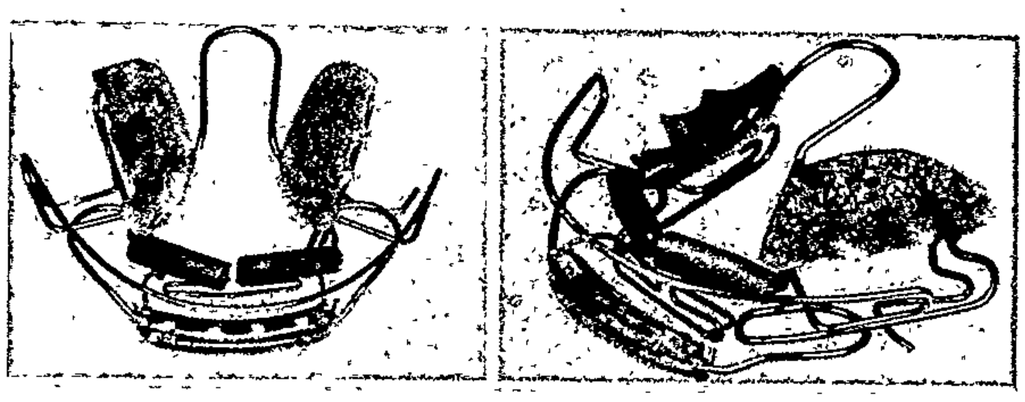
The Schwarz Bow Activator has upper and lower elements joined by wire loops.



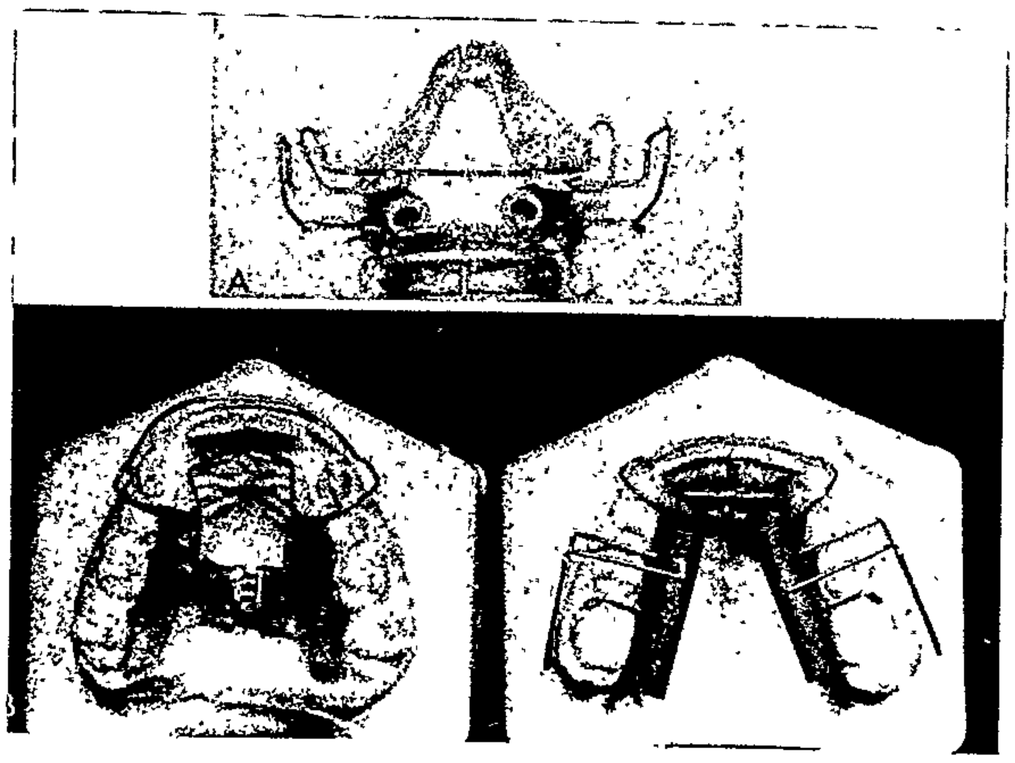
The Schwartz Bow Activator.

Several other activator type appliances with reduced bulk of acrylic and connecting wires have been developed in Europe. The aim of this line of development has been to make the appliance more acceptable for extended periods of day wear as well as at night.

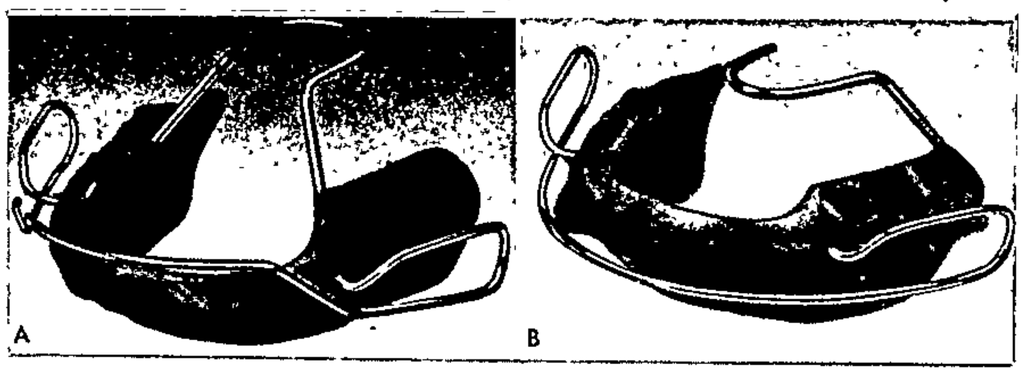
The Bimler, Kinetor, Bionator and Elastic Open Activator are examples of this group of functional appliances.



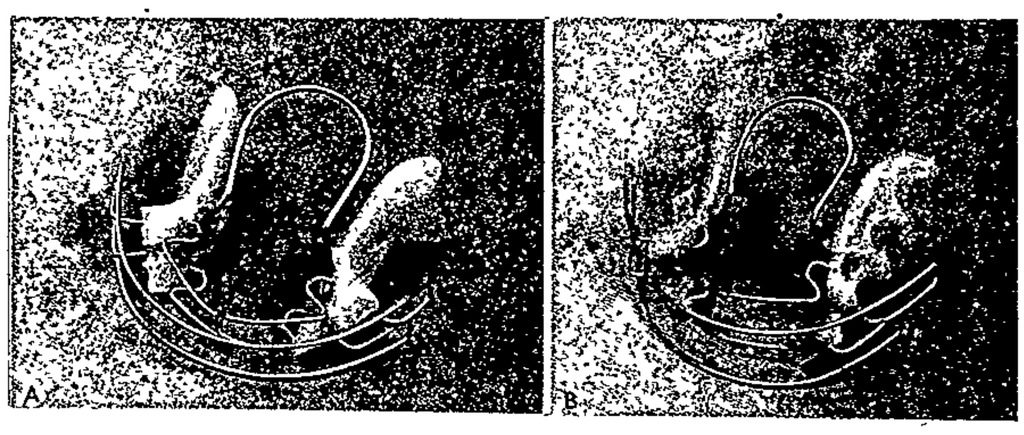
The Bimler Appliance



The Stockfisch Kinetor



The Bionator



The Klammt Elastic Open Activator

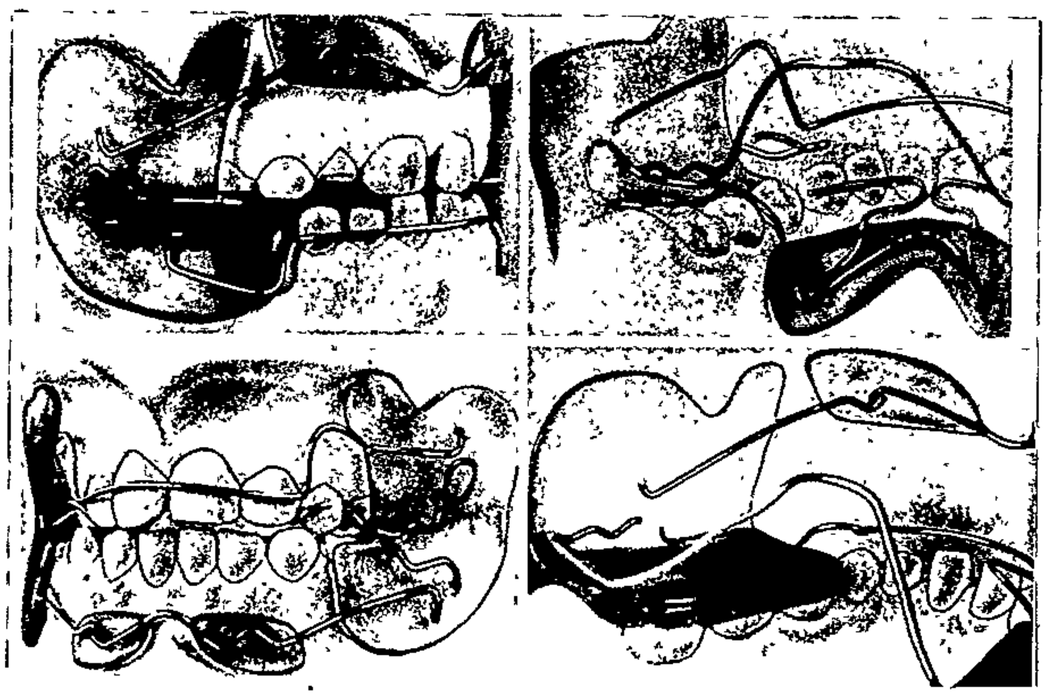
Neumann (1975) has described and discussed these appliances.

The Stockfish Kinetor has resilient plastic tubes separating acrylic platforms on the palatal and lingual sides of the upper and lower teeth. These tubes are compressed by the acrylic components of the appliances and not by the buccal teeth. Stockfish (1977) claims that the resilient tubes stimulate muscular activity. The reduced tongue room may be a

disadvantage but Stockfish does not consider it to be a problem. Stockfish requests schoolteachers to supervise the wearing of the appliance while the patient is at school.

The problem of determining actual wearing times, and differentiating between interceptive and symptomatic treatment and retention, makes the comparison of reported results, obtained with different types of functional appliances, difficult.

The Frankel Regulators (1971, 1974, 1975) have been designed to overcome some of the disadvantages of the Andresen-Haupl activator. In addition to this, their advocates claim the appliance allows alveolar expansion by shielding the buccal teeth from cheek pressure and by the periosteal stimulation of bone deposition on the buccal surface of the alveolus.



Frankel Regulator

Some work by Donnelly et al (1973) may support the theory of bone deposition by periosteal tension.

Frankel (1971, 1974, 1975), Eirew (1976) and Jenkins (1977) state that:

1. The reduced acrylic bulk allows full-time wear.

2. Absence of lower tooth contact reduces the proclination of the lower incisors.
3. Arch expansion may be obtained by stimulating alveolar bone remodelling and relief of cheek pressure.

Three streams of appliance design have emerged.

One trend is for reduced-bulk, comfortable, continuous usage appliances. The Bimler, Bionator, Elastic Open Activator and Frankel appliances are examples.

The Woodside, Harvold, Vargervik group use appliances producing maximum stretch stimulation. Higher force levels may result but the appliances are less suitable for continuous wear.

The third type is that of Herren and Demisch. This has a forwardly over compensated working bite, and clasps on some upper teeth aid retention.

5. Treatment Objectives

The determination of treatment objectives is of concern to every orthodontist. The difficulty of obtaining agreement among the subjective severity assessments of different orthodontists is currently receiving considerable attention(Freer et al 1973, Freer 1975).

Horowitz and Hixon (1966) discuss diagnosis and treatment planning in terms of the scientific method. They claim "both are concerned with:

1. defining a condition or problem as precisely as possible.
2. formulating concepts and working hypotheses.
3. determining how and when the condition may best be treated or the problem solved.

Most importantly the successful practice of both is ultimately determined by the concepts that are held by the individual clinician or scientist and the manner in which he applies them in meeting his daily problems".

Rix (1960) has said "Orthodontic treatment is seldom able to produce a complete and morphological ideal dentition. In general terms it aims at making a compromise with Nature in order to improve appearance and to create stable conditions which favour the long survival of the healthy dentition".

The limitations of the activator have often been stated (Tulley 1972, Dickson et al 1965, Harvold 1974).

There are, therefore, many cases for which an activator appliance is contraindicated. For those cases where an activator could be used, the decision to do so depends on the treatment concepts of the clinician.

If the aim is to produce an ideal occlusion then the multi-banded fixed active appliance is the choice. If one follows the Rix concept of "a compromise with Nature" then the use of functional appliances may be more suitable.

Where the activator is used as an interceptive appliance the case may need further treatment with a fixed active appliance at a later date (Gates 1976, Harvold 1974).

The role of the clinician has to be considered from a further view point. Should the clinician provide the cure or the means for the patient to cure himself or herself.

If one takes the view that the cure should be provided, then the clinician must use appliances and methods which are, ideally, totally within the limits of his control and independent of the patient. Fixed active appliances are much nearer to this requirement than are functional appliances.

The functional appliances are a means by which the patients, largely by their own efforts, cure themselves.

Appreciation of this difference of approach is necessary if we are to avoid the unnecessary argument concerning comparison of fixed active and functional

appliances. They are for so completely different purposes that they cannot be compared. Evaluation of the results must take into account the means by which they were obtained.

It may be often easier but not necessarily better to provide the cure than to teach the patient the use of functional appliances to cure himself or herself.

ORIGINAL WORK

6. Purpose of Study

The central purpose was to test by clinical trial a new activator design to be used in conjunction with daytime use of a maxillary bite plate.

Further, a particular method of patient education, instruction and motivation was employed as a feature of the clinical trial.

The results are reported, discussed and compared with other activator studies.

7. Material

14 patients from the waiting lists of the Orthodontic Departments of the United Dental Hospital and the Dental School in Sydney were selected.

The group consisted of 12 non-crowded class II division I cases, one class II division 2 type and one class I deep bite case. There were 8 males and 6 females aged from 9 to 16 years.

8. Method

The Appliances

A modified Andresen-Haupl type activator was used.

A separate maxillary bite plate appliance with an active labial bow was also provided.

Appliance preparation and design

Alginate impressions were extended into the sublingual area to allow maximum tolerable lingual flange extension. The extended lingual flanges hold the activator against the upper buccal teeth to restrict their downward and forward movement, providing additional anchorage, retention and stability. This is necessary because some loss of stability results when the acrylic of the processed appliance is completed.

Thw working bite aimed at was 2/3 of the maximum protrusive movement with a vertical opening of 3-4 mm at the incisors, from the rest position. Reference to the working bite tracings shows that this usually resulted in the incisors being approximately edge to edge and from 2-3 mm apart.

All of the activators incorporated a Rix-type (Rix 1966) anterior airway and a 0.9 mm diameter labial bow with large adjustable u loops. 0.7 mm canine retraction and expansion spurs with the tips rounded with solder were used where needed.

The bite-plates had an anterior bite opening platform, 0.9 mm labial bows with large adjustment u loops, and 0.7 mm Adam's clasps. The labial bows of the activators and bite plates were activated to produce retraction of the incisors. Bite plate appliance acrylic was removed from behind the incisors to allow tooth movement.

9. Method

The Patient

The presentation and explanation of the treatment to the patient is of paramount importance. This author is of the opinion that patient co-operation may seldom be achieved simply by prescribing a set wearing time regime. The patient must first understand the mode of action of the appliances. Accordingly it was explained to the patient that:-

1. The activator is of greatest benefit and will produce results if worn for more than 14 hours each day.
2. The longer the wearing time each day the more rapid will be the achievement of the desired result.
3. Use of the bite plate when the activator cannot be worn is essential if rapid results are desired.

4. Full time use of the activator is encouraged but not demanded.

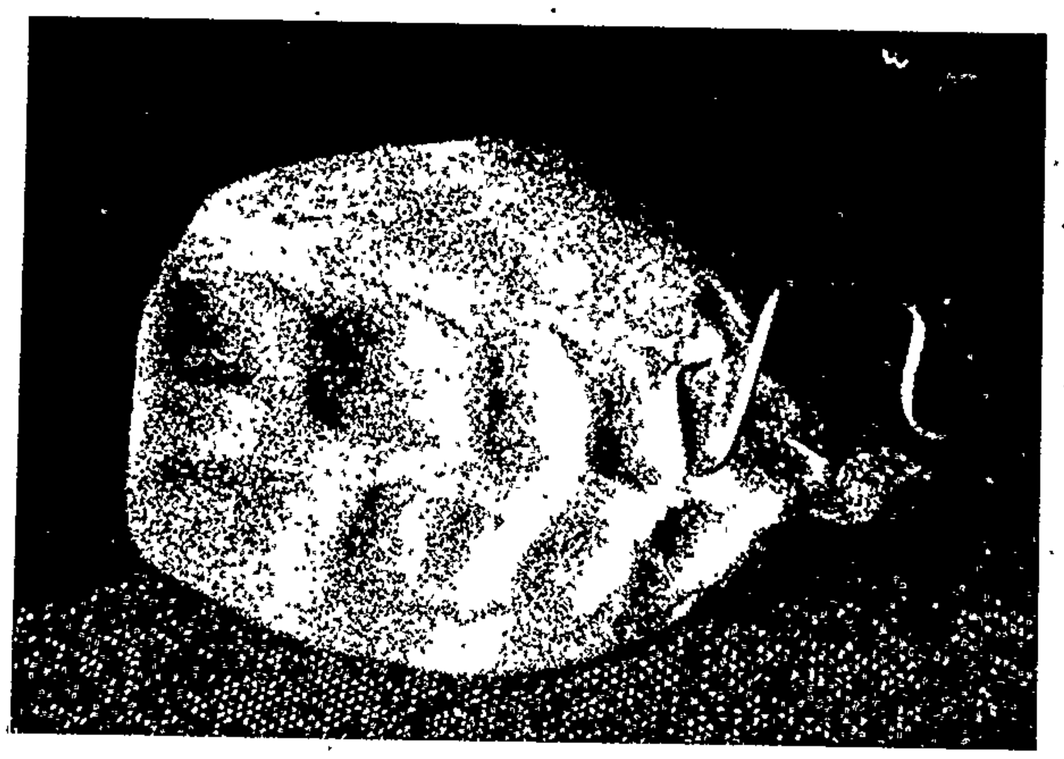
5. The daily regime must be the responsibility of the patient. This allows variation to suit individual circumstances.

6. Patients are requested to keep a wearing time log book and to bring it at each visit for presentation and discussion.

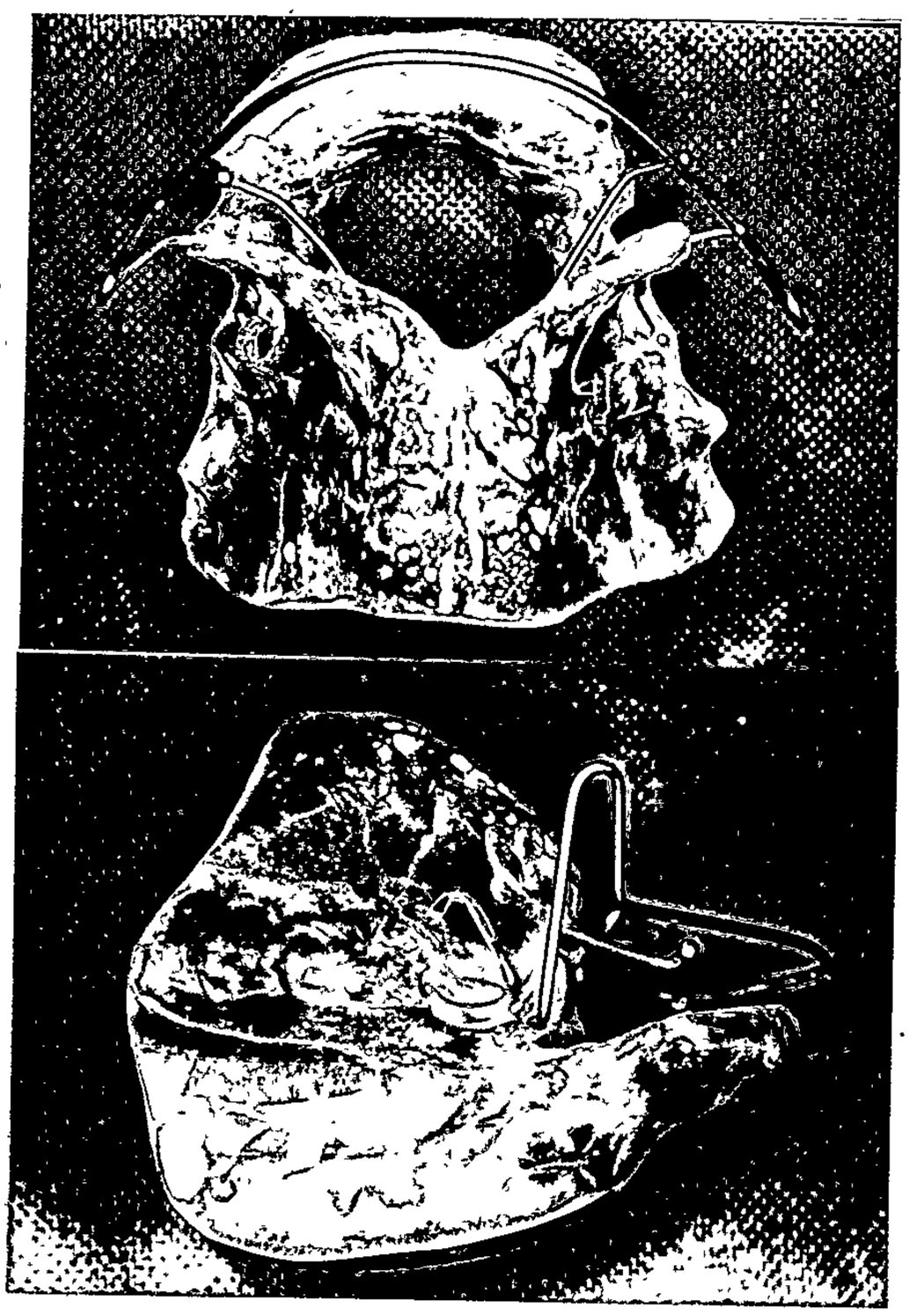
7. Continuous use of the appliances with a minimum of 14 hours activator is essential if the patient is to achieve a favourable result. Removal of the appliance for cleaning and tooth brushing is essential. Removal of the bite plate for meals is permitted but explained to be a disadvantage to progress.

8. Tooth movements are demonstrated. Patients are shown how, and encouraged to regularly observe and report their progress.

10. The Appliances



The Andresen Haupl Appliance



The Modified Andresen Haupl

appliance use by N.B.

This appliance had an anterior airway, upper canine retraction spurs and the lower incisor capping (Rix 1966), sublingual flange extensions and lower buccal segment clearance trimming (Harvold, (1974) Vargervik, Woodside (1970)) and a working bite similar to that used by Herren (1972).

The Activator

The activator design must be varied to suit the particular requirements of each case. Harvold (1974) makes this point with his detailed discussion of appliance design for each case. The principle must be accepted as valid even if it is sometimes difficult to obtain agreement on the particular requirements.

The reasons for using the general design modifications are listed:

1. The anterior airway makes the appliance more acceptable for extended wearing times.
2. The canine spurs retract and expand the canines.
3. Lower incisor capping may reduce the forward tipping of these teeth.
4. Trimming the acrylic free of the lower buccal teeth allows unrestricted eruption of these teeth.
5. The extended lower lingual flanges aid retention and anchorage.
6. The working bite position chosen was less extreme than that advocated by Harvold and Vargervik (1974) and Woodside (1970). This was done with the hope that extended wearing times may be achieved. A

tracing of the working bite position is shown for each case. 14 hours or more of activator time each day is required.

7. The design was kept as simple as possible to facilitate fabrication and maintenance of the appliance.

The Bite Plate

The other appliance used in combination with the activator was a maxillary bite plate.

The Activator and
Bite Plate used for M.B.

This was a Hawley type appliance with an active labial bow and anterior bite opening platform. The bite platform may be converted into a guide plane or incline plane to stabilize a dual bite. Hotz (1974, p. 267) believes the difference is important.

The reasons for using a bite plate as well as an activator are listed:

1. The bite plate is used for the time each day when the activator cannot be used.
2. The bite opening effect of the activator is maintained by the bite plate.
3. The incline planes of the cusps of opposing teeth must initially tend to return those teeth to their original positions if the teeth are allowed to come together when the activator is not used. The bite plate prevents this effect.
4. If there also exists a functional distal retrusion of the mandible, it is more likely to change if the teeth are kept out of occlusion.
5. Combined appliance therapy hastens the retraction of upper incisors. This change is obvious to the patient and becomes a motivation stimulus, maintaining his or her self-treatment effort.

The bite plate-activation combination has been mentioned but apparently not found useful by Hotz (1974 P. 277). If upper arch expansion is required, centreline expansion screws could be used.

Fabrication of Appliances

The method described by Adams (1970) was found to be quite suitable for the construction of the appliances. Coating the outside of the wax activator with a thin layer of stone before flasking in plaster is an advantage. If the stone covering is smoothed and

greased,deflasking is fast and clean.

An alternative method is to construct the upper and lower halves of the activator by the direct Orthocryl application technique. The upper and lower casts are then remounted on an articulator set to the working bite registration. The two halves of the appliance are then joined with Orthocryl, removed from the casts, trimmed and polished.

11. Appliance Adjustments

The appliances must at all times fit well without causing discomfort. Pressure spots causing soft tissue irritation or ulceration sometimes have to be reduced.

The active labial bows of both the activator and the bite plate are adjusted at each visit to maintain a retraction force on the incisor teeth. Acrylic is removed where necessary to allow teeth to move in the desired direction. Care must be taken to ensure that the labial bow wire does not obstruct the expansion or retraction of the upper canine teeth.

The method of trimming the activator is determined by the tooth movements required. In the early stages of treatment maximum anchorage may be required for the retraction of protruding incisors. There are advantages in maintaining acrylic in close contact with the lower buccal teeth at this time. This reduces the forwardly directed force on the lower incisors and lower anterior alveolus, thus reducing lower anterior proclination. When the upper incisors and canines have been retracted the lower buccal teeth may be allowed to erupt by removing the acrylic from their occlusal and lingual surfaces.

Activators with inadequate extension of the sublingual flanges tend to dislodge downwards at the back when the acrylic is trimmed free of the lower buccal teeth. This must interfere with the intended eruption restriction and distal tipping of the upper

buccal teeth.

Reduction of acrylic from the central palate and addition of acrylic by direct relining of the lateral palatal area promotes some upper arch expansion. Alternatively a centreline expansion screw may be incorporated in the initial design. Positioning a centreline expansion screw becomes more difficult if an anterior airway is used.

12. Records

The following records were taken at the beginning and at the end of the reported treatments. Mid-treatment records were taken for a few of the cases.

1. Lateral cephalograms with the teeth in centric occlusion.
2. Facial and intra-oral photographs.
3. Dental casts.

Additional records were taken at the beginning of treatment.

1. Lateral cephalograms with the activator in place.
2. Thumb joint radiographs.

Existing cephalograms were used if they had been taken in the 6 months before treatment was started. Because of this, and because of occasional delays in starting treatment, the treatment durations for some of the cases are considerably less than the dates of the records indicate. All radiographs were obtained by routine referral of patients to the X Ray Department of the United Dental Hospital, Sydney.

Tracing and Measurement of Radiographs

The radiographs were traced on Kodatrace in a dark room using a Rayvue cephalogram viewer. The film was framed with masking paper. This ensured that the only light to reach the observer passed through the film. A Morison Mecha automatic clutch pencil with 0.5 mm H.B. carbon lead was used.

Measurements were taken from the Kodatrace

tracings.

Superimposed tracings were then made with 0.3 Standardgraph Indian ink pen on clear polyvinyl-chloride sheet. The prints were made from these tracings by the Photography Department of the United Dental Hospital.

Points and Planes of Reference

The definitions of the pcints and planes of reference are those currently used in the M.D.Sc. course at the Sydney University Orthodontic Departmnnt.

1. Sella: S.

   The midpoint of the sella turcica determined by inspection.

2. Nasion: Na.

   The most anterior point of the naso-frontal suture usually seen in the normal lateral film as a dark line representing the suture where the two nasal bones intersect with the frontal bone.

3. Pogonion: Pg.

   The most anterior point of the bony chin.

4. Anterior Nasal Spine: ANS.

   The tip of the anterior nasal spine.

5. Point "A", Subspinale.

   The most posterior point in the depth of the concavity of the maxillary alveolar process on the labial surfaces above the central incisors.

6. Point "B", Suprementale.

   The most posterior point in the concavity of the

anterior portion of the body of the mandible.

7. Gnathion: Gn.

The point on the lower margin of the mandible in the median sagittal plane, roughly where the anterior curvature becomes confluent with the base. It is located by bisecting the angle formed by the mandibular and facial planes.

8. Sella-Nasion line: S.N.

Joining Sella to Nasion.

9. Occlusal Plane: O.P.

Represented by a line of best fit for the points of molar and premolar occlusal contact.

10. Mandibular Plane: M.P.

Represented by a line tangential to the posterior part of the lower border of the mandibular outline and to the lower margin of the symphyseal outline.

11. Facial Line ("Plane"): N.Pg.

Joining Nasion to Pogonion.

12. Y Axis

The line joining S to the intersection of the facial line and the mandibular plane.

13. A.Pg. Line

The line joining Point A to Pogonion.

Measurements made on the Lateral Cephalograms

SN: Pg. (degrees)

The antero-posterior skeletal relationship of the mandible to the cranium.

Y Axis (degrees)

The anterior angle made by the Y Axis and S.N.

MP: SN (degrees)

The vertical skeletal relationship of the mandible to the cranium.

S.N.A. (degrees)

The antero-posterior skeletal relationship of the maxilla to the cranium.

A.N.B. (degrees)

The antero-posterior skeletal relationship of the mandible to the maxilla.

Upper central incisor axis to S.N. Posterior angle (degrees)

The angular relationship between the upper central incisors and the cranium.

Upper central incisor crown to A.Pg. (mm)

The horizontal linear relationship of the upper central incisor crown to the face.

Lower central incisor axis to MP. (degrees)

The angular relationship between the lower central incisor and the mandibular plane.

Lower central incisor to A.Pg. (mm)

The horizontal linear relationship of the lower central incisor crown to the face.

The Inter-incisal Angle (degrees)

The angular relationship between the axes of the upper and lower incisors.

OP to MP (degrees)

The anterior-posterior dental height differential.

A.N.S. to Gn. (mm)

Lower face height

Life sized superimposed before and after tracings are presented. This was considered to be the best way of presenting the results. The serial tracings of the lateral cephalograms were superimposed on S.N. at S.

Serial superimposed tracings of the maxilla and mandible were also made.

The choice of reference points and planes was influenced by what could be clearly defined on the cephalograms.

13. Case Reports

3-9-76

7-7-77

Patient Details

M.B. Male

D.O.B. 30-3-67

Prepubertal.

Class 11 Division 1

Right side full cusp, left side ½ cusp.

O.B. 4 mm O.J. 10 mm.

Marked upper incisor protrusion

Mouth breathing. Marginal gingivitis. Lips always apart.

Lower lip inside upper incisors.

Upper spacing. Lower incisor irregularity. L.L.C. missing.

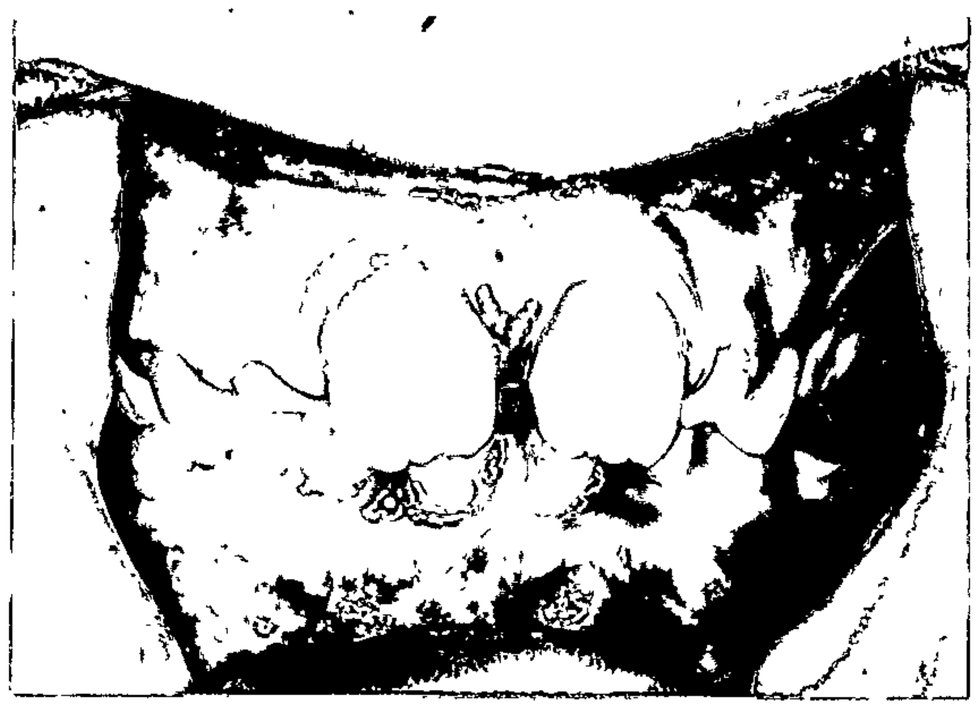
3-9-76

7-7-77

M.B.

Treatment Notes

19-5-76	Exam and records.
3-9-76	Impressions and records.
22-9-76	Start activator and bite plate.
21-10-76	Lower buccal clearance trimming. Start time sheets.
4-11-76	Activator broken. Continue bite plate full time.
24-11-76	Repair activator. Continue both appliance.
10-2-77	Has used bite plate at school, activator at other times.



3-9-76

7-7-77

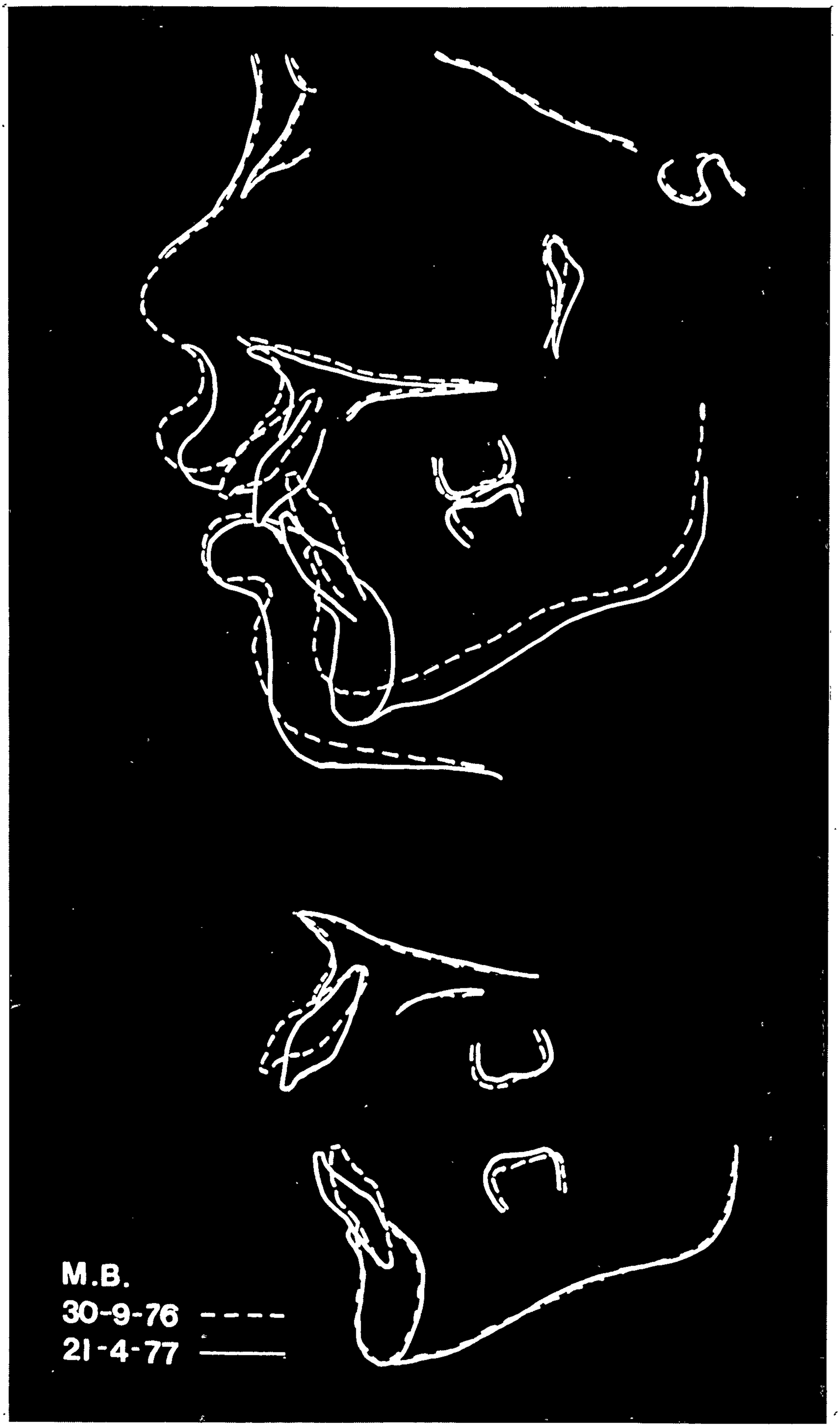
7-3-77	Records.
21-4-77	Continue with both appliances.
16-6-77	Stop bite plate. Activator evening and sleeptime.
17-7-77	Records. Sleeptime activator. Anticipate phasing out activator over next 12 months. Observe developing dentition. May require further treatment.

Working Bite

M.B.

Treatment Summary

1. Patient accepted both appliances.
2. Returned completed time sheets.
3. Noticed changes and became enthusiastic about treatment.


M.B.
30-9-76 - - - -
21-4-77 ——

M.B.

Treatment Analysis

Measurement	Before	After	Change 11 months*
S.N. Pg^0	75	75.5	0.5
Y Axis	70	70	0
M.P. to S.N.^{0}	36	35.5	-0.5
S.N.A.^{0}	80	80	0
A.N.B.^{0}	6	6	0
$\underline{1}$ to S.N.^{0}	116	103	13
$\underline{1}$ to A.Pg. mm	12	8	-4
$\overline{1}$ to M.P.^{0}	95	104	9
$\overline{1}$ to A.Pg. mm	0	4	4
$\underline{1}$ to $\overline{1}$	113	117	4
O.P. to M.P.^{0}	22	17	-5
A.N.S. to Gn. mm	64.5	66.5	2

1. Small growth increment.
2. Incisor angulation change.
3. Small vertical dimension change.
4. Forward eruption of lower molars.
5. Distal movement of upper molars.
6. Improved posture of lips.
7. Upper incisors inside but may not yet be contained by lower lip.
8. Anticipate continued sleeptime use of activator.

9. Review permanent dentition and consider fixed appliances.

* Actual treatment time 8 months.

13-9-76

27-4-77

Patient Details

N.B. Female

D.O.B. 31-3-63

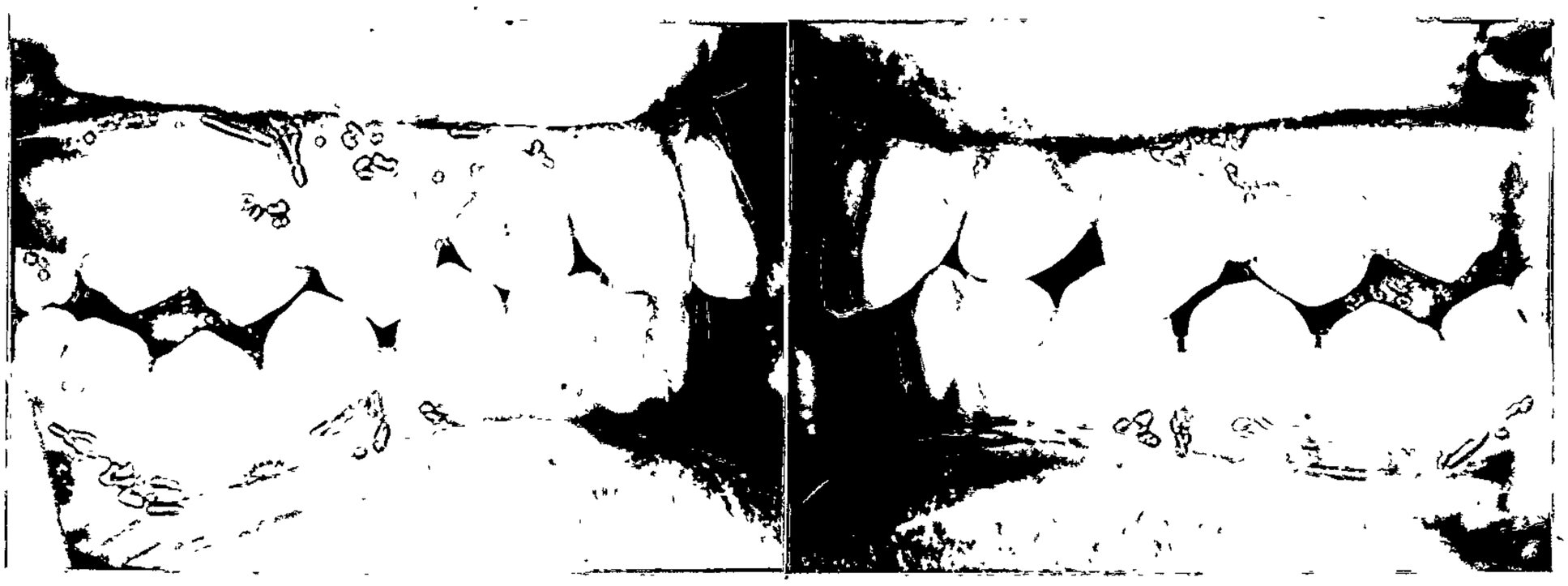
Circumpubertal 1976

Half cusp Class 11 Division 1.

O.B. 5 mm. O.J. 10 mm.

Lips constantly apart. Short upper lip. Lower lip partly inside upper incisors. Mouth breathing. E's exfoliating. Sufficient arch length. Upper and lower bicuspid contraction. Increased curve of spee. Minor upper incisor rotations.

13-9-76

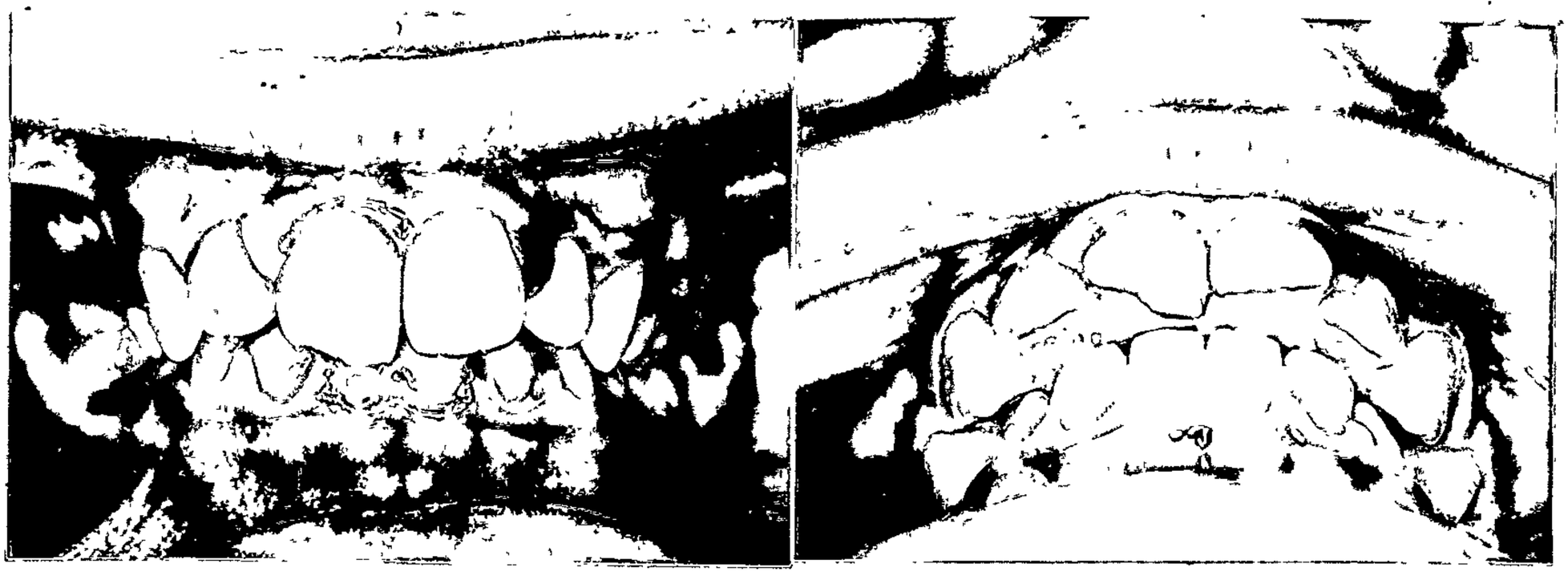


27-4-77

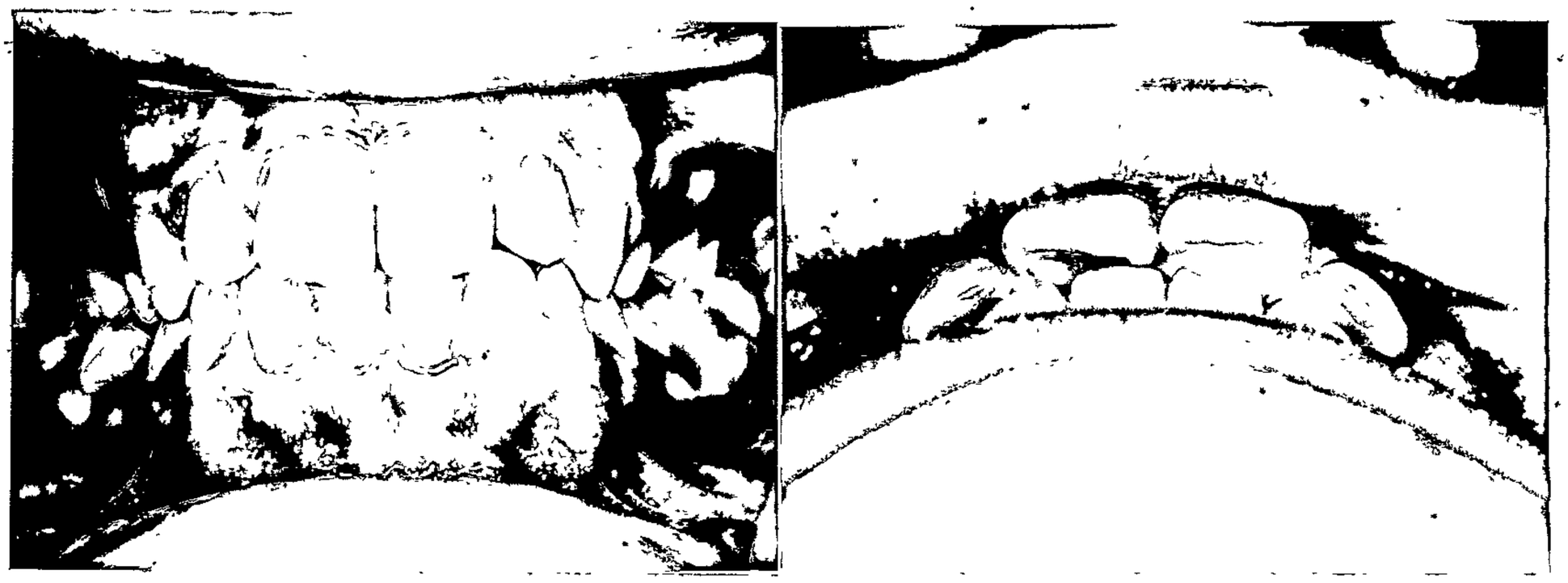
N.B.

Treatment Notes

13-9-76	Records. Impressions. Ext. remaining E's.
28-9-76	Issue activator. Advised to wear as much as possible. Lower buccal teeth acrylic trimmed free.
14-10-76	Issue bite plate. Advised to use when unable to use activator. Issue time sheet.
17-11-76	Prefers to use activator almost full time. Molars Class I.
7-2-77	Has continued full time use. Advised to reduce to sleep plus 2 hours.



13-9-76



27-4-77

21-3-77	Reline palate to help upper arch expansion. Adjust spurs to expand and retract 3/3. Adjust labial bow to rotate 1/1. Records.
27-4-77	Reline palate for more expansion. Wear sleep time only. Records.
7-6-77	Trim to allow further eruption
19-7-77	Records. Use every second night. Anticipate phasing out retention over next 6 months.

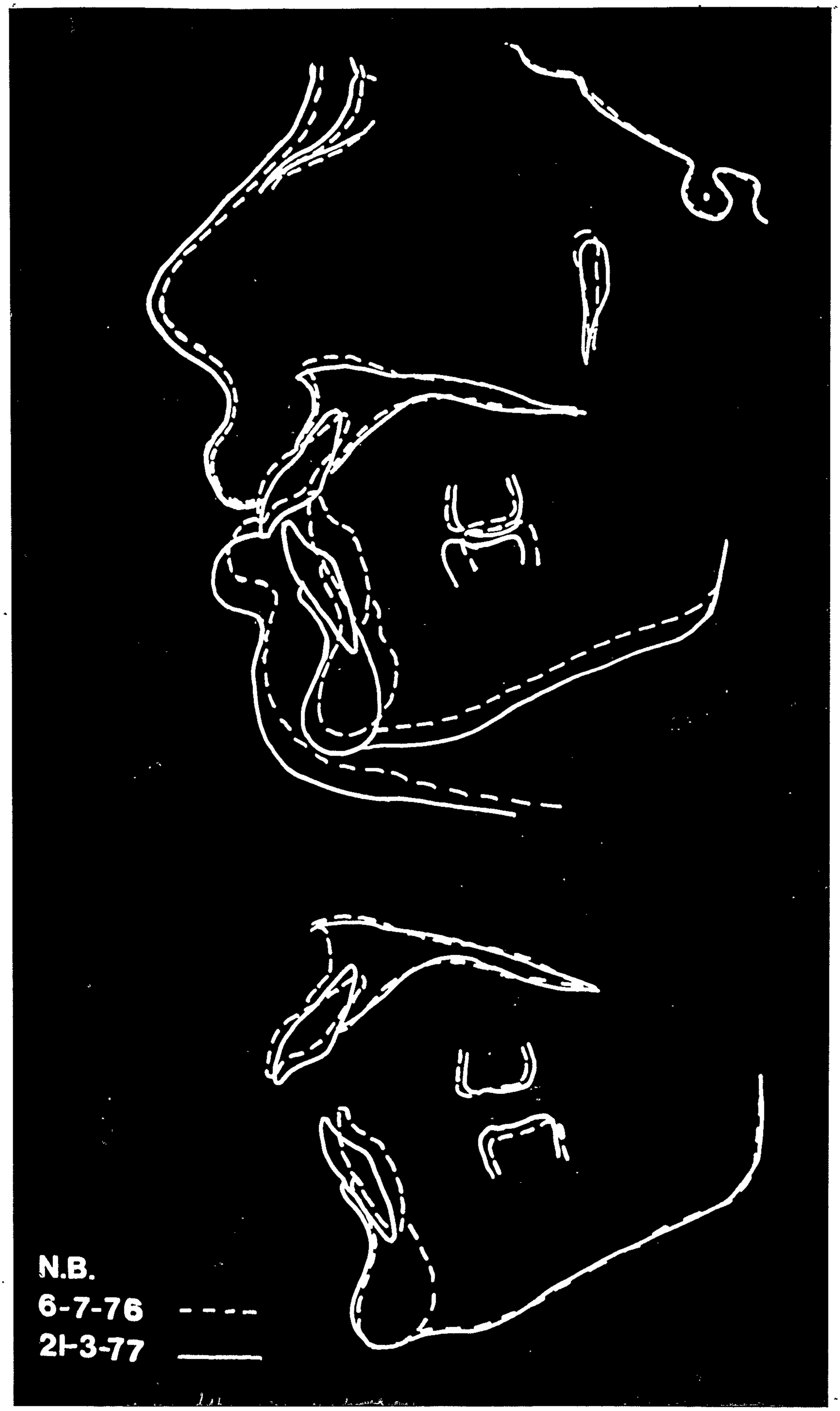
654/456

Working Bite

N.B.

Treatment Summary

1. This patient responded well to the self treatment concept.
2. Completed time sheets were returned.
3. They were discontinued when high motivation and full time use of the activator occured.
4. An appliance design with an expansion screw may have been an advantage.


N.B.
6-7-76 - - - -
21-3-77 ____

N.B.

Treatment Analysis

Measurement	Before 7-76	After 3-77	Change 8 months
S.N., Pg^0	75	75	0
Y Axis	74	74	0
M.P. to S.N.^{0}	39	39	0
S.N.A.^{0}	79	77.5	-1.5
A.N.B.^{0}	6	4.5	-1.5
$\underline{1}$ to S.N.^{0}	110.5	99.5	-11
1 to A.Pg. mm	10	8	-2
$\overline{I}$ to M.P.^{0}	91.5	98	6.5
$\overline{I}$ to A.Pg. mm	0	4	4
$\underline{1}$ to $\overline{I}^0$	119.5	124	4.5
O.P. to M.P.^{0}	21.5	19.5	2
ANS, Gn. mm	66.5	68.5	2

1. Incisor angulation changes.
2. Class 1 molar relationship. Reduced overbite, overjet relationship. Upper arch spacing indicates retraction of upper canines.
3. Lip closure occurs much more frequently but still shows strain.
4. Patient claims increased nose breathing.
5. Some growth increment.

6. Improved upper and lower arch form.
7. Anticipate phasing out retainer over next 6 months.
8. No further treatment planned. Maintain 6 monthly observations.

13-9-76

11-5-77

Patient Details

G.H. Female

D.O.B. 72-10-67

Prepubertal

Mild Class 11 Division 1.

O.B. 2 mm. O.J. 5.5 mm.

Competent lips. Good facial contour.

lst biscuspids and canines erupting.

Adequate arch lengths.

Tongue thrust with incomplete overbite.

13-9-76

11-5-77

G.H.

Treatment Notes

13-9-76	Exam. Records.
29-9-76	Start activator and bite plate. Requested to use bite plate when unable to use activator.
11-10-76	Patient prefers activator. Start time sheet.
29-10-76	Wearing activator almost full time.
31-11-76	Almost full time wear.
24-2-77	New activator to procline 2/7 and attempt centreline correction.

13-9-76

11-5-77

10-3-77 New activator started.

31-3-77 Reported to come out some nights when asleep.

4-4-77 Continue maximum wearing time.

11-5-77 Use nights only. Records.

6-7-77 Continue night use as retainer.

8-8-77 Continue afternoon use as retainer.

Patients prefers afternoons to nights.

Anticipate continued use to control tongue thrust.

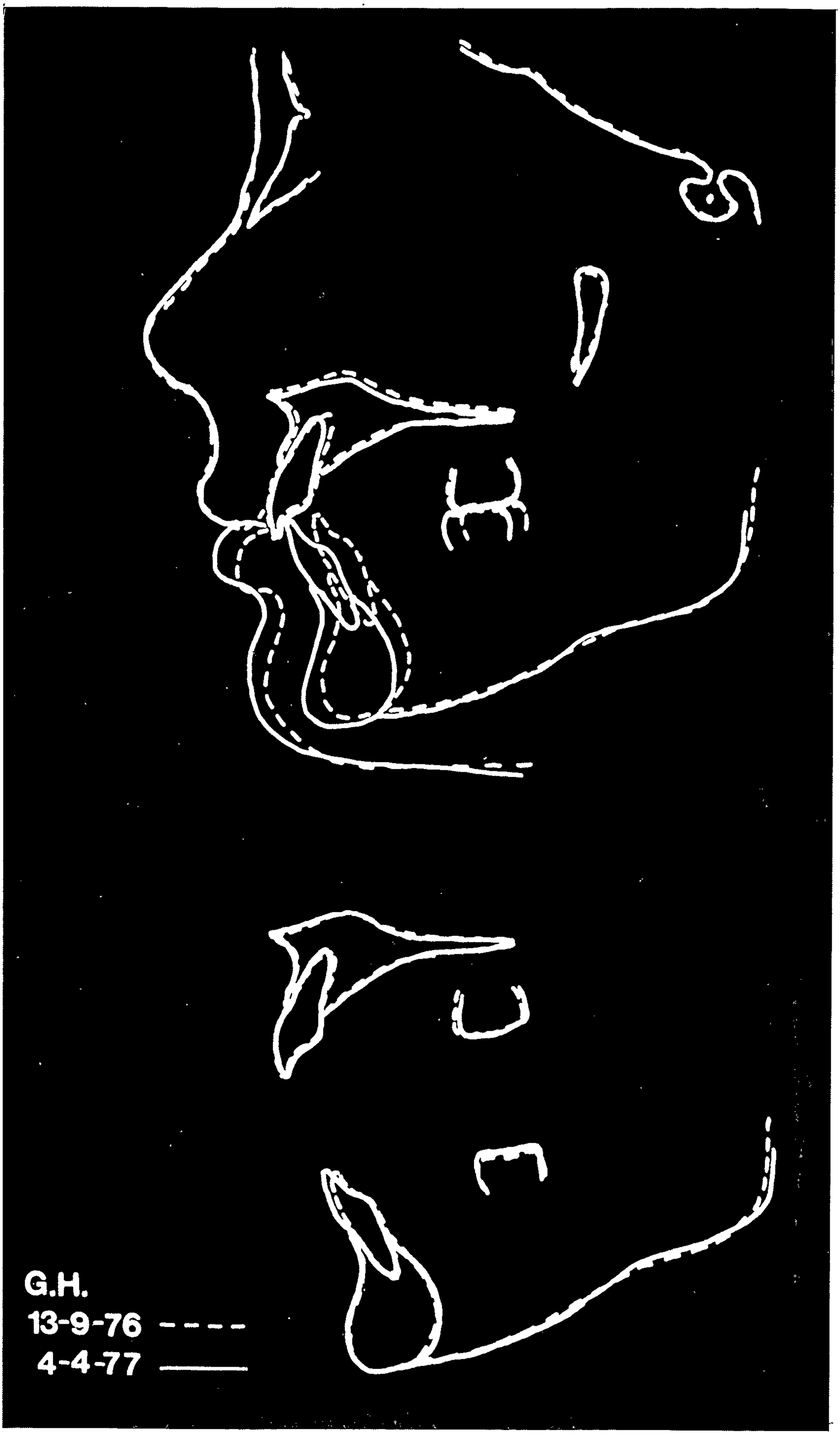
Maintain observation of developing dentition

Working Bite

G.H.

Treatment Summary

1. Patient chose to use activator almost full time.
2. For retention patient chose to wear retainer from after school to bed time in preference to sleep time.


G.H.
13-9-76 - - - - -
4-4-77 ———

G.H.

Treatment Analysis

Measurement	Before	After	Change 7 months
	9-76.	4-77.	
S.N. Pg.^{0}	76	77	1
Y Axis	65.5	65	-0.5
M.P. to S.N.^{0}	30	30	0
S.N.A.^{0}	79	79.5	0.5
A.N.B.^{0}	5	4.5	-0.5
$\underline{1}$ to S.N.^{0}	104	96	-8
$\underline{1}$ to A.Pg. mm	5.5	3	-2.5
$\overline{1}$ to M.P.^{0}	100	103	3.
$\overline{1}$ to A.P. mm	-2	0	2
$\underline{1}$ to $\overline{1}^0$	126	130	4
O.P. to M.P.^{0}	11	9	-2
A.N.S., Gm. mm	55.5	56.5	1.

1. Forward mandibular repositioning.
2. Overbite, overjet correction.
3. Buccal segments adjusted to Class 1.
4. Attempt to correct centre line with offset working bite unsuccessful.
5. Tongue thrust controlled. Prognosis uncertain.
6. Continue use as retainer.

9-2-77

10-8-77

Patient Details

M.B.C. Female

D.O.B. 19-2-65

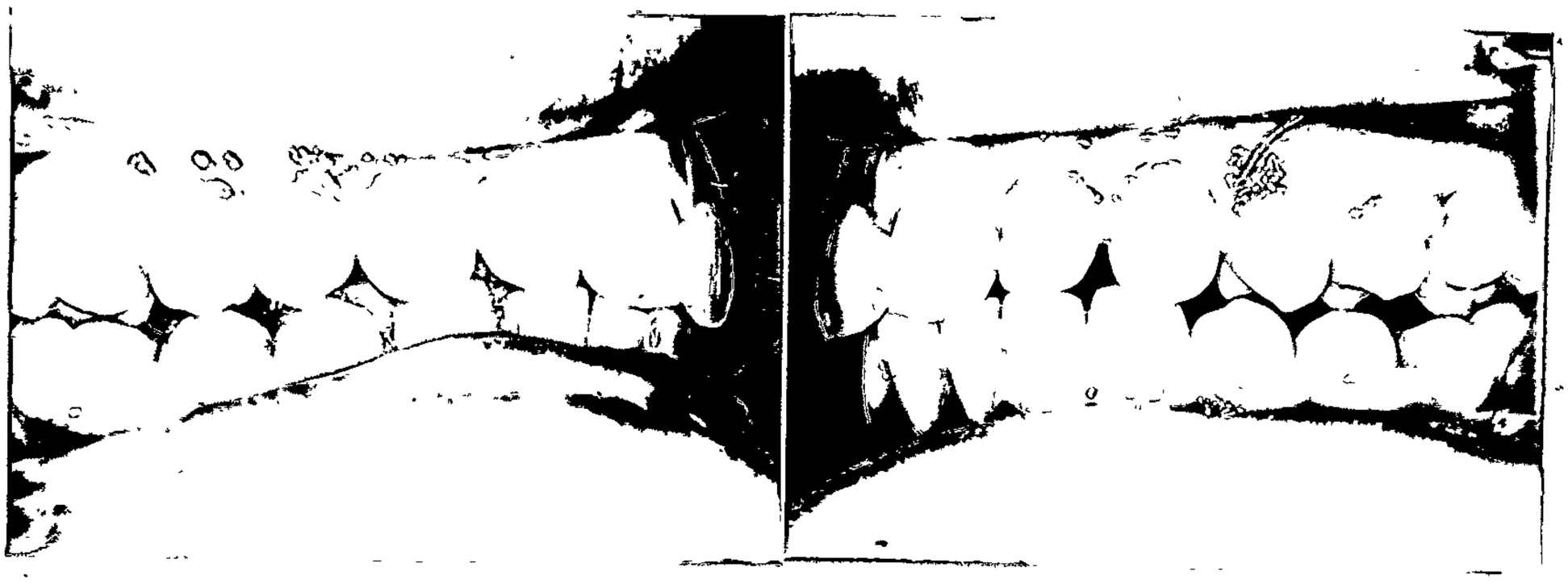
Circumpubertal

Class 11 Division 1,

Full cusp right side, ½ cusp left side

O.B. 5.5 mm, O.J. 8.5 mm

Lips habitually apart. Upper incisors outside control of lower lip. Slight spacing upper and lower teeth.



9-2-77

10-8-77

M.B.C.

Treatment Notes

11-3-76	Exam and records. Impression. Sesmoid adductor present.
29-4-76	Activator issued.
17-6-76	Activator inadequate. Needs new appliance Incorrect working bite.
3-9-76	Impression for new appliance.
17-9-76	Rix design inserted.
12-10-76	Patient now using appliance. Claims airway much more acceptable.
9-2-77	Records. Lower buccal clearance trimming. Impression for bite plate.

9-2-77

10-8-77

22-3-77	Start bite plate. For use when unable to use activator. Extra acrylic capping added to lower incisors.
21-4-77	Dual bite. Incline plane added to bite plate.
3-5-77	Has flu. Using bite plate only.
7-6-77	Reline palate of activator. Using both.
5-7-77	Using both.
10-8-77	Left side Class 1. Right side almost. Records. Treatment continuing.

Working Bite

M.B.C.

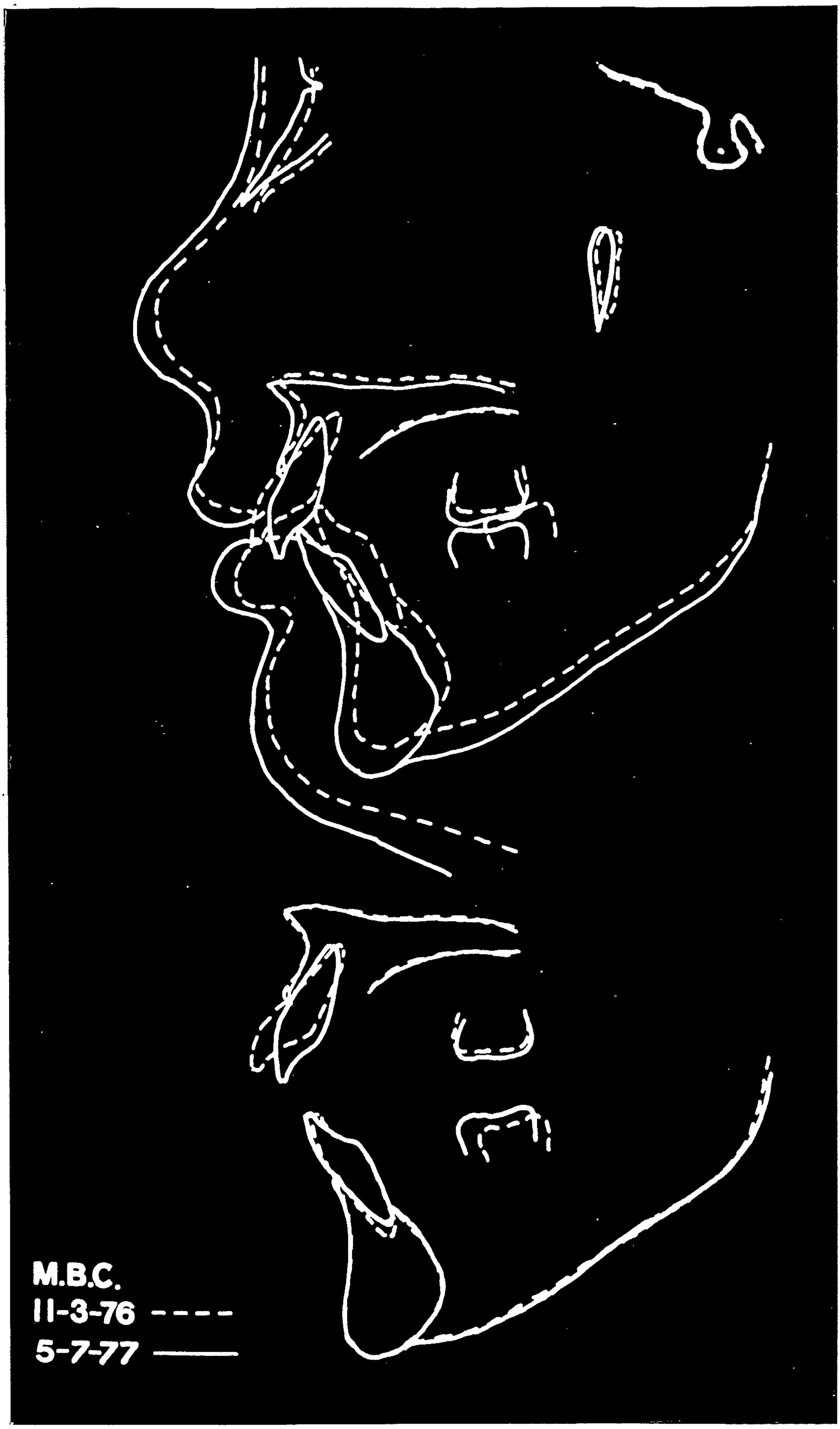
Treatment Summary

1. 11-3-76 to 3-9-76 treatment by other clinicians.

2. Reasonable progress using combination of bite plate and activator. Activator used evenings and sleep time.

3. Growth peak had occured just before this treatment phase.

4. Incline plane probably helped stabilize dual bite but possibly increased lower incisor proclination.


M.B.C.
11-3-76 - - - -
5-7-77 ——

M.B.C.

Treatment Analysis

Measurement	Before 3-76.	After 7-77.	Change 15 months*
S.N.Pg.^{0}	77.5	79	1.5
Y Axis^0	68.5	68	-0.5
M.P. to S.N.^{0}	38.5	37.5	-1
S.N.A.^{0}	83	83.5	0.5
A.N.B.^{0}	6.5	6	-0.5
$\underline{1}$ to S.N.^{0}	114	97	-17
$\underline{1}$ to A.Pg. mm	12	6	-6
$\overline{1}$ to M.P.^{0}	94.5	100	5.5
$\overline{1}$ to A.Pg. mm	-0.5	2	2.5
$\underline{1}$ to $\overline{1}$ ^{0}	113	124	11
O.P. to M.P.^{0}	22.5	19	-3.5
A.N.S. to Gn. mm	66.5	71	4.5

1. Incisor angulation changes.
2. Occlusal plane change.
3. Vertical dimension change.
4. Some growth increment.
5. Molar relationship changed by retardation of forward movement of upper molars and promotion of forward eruption of lower molars.
6. Considerable improvement of lip posture.

* Little change for first 6 months because of design of first appliance.

27-10-76

18-3-77

Patient Details

P.K. Female

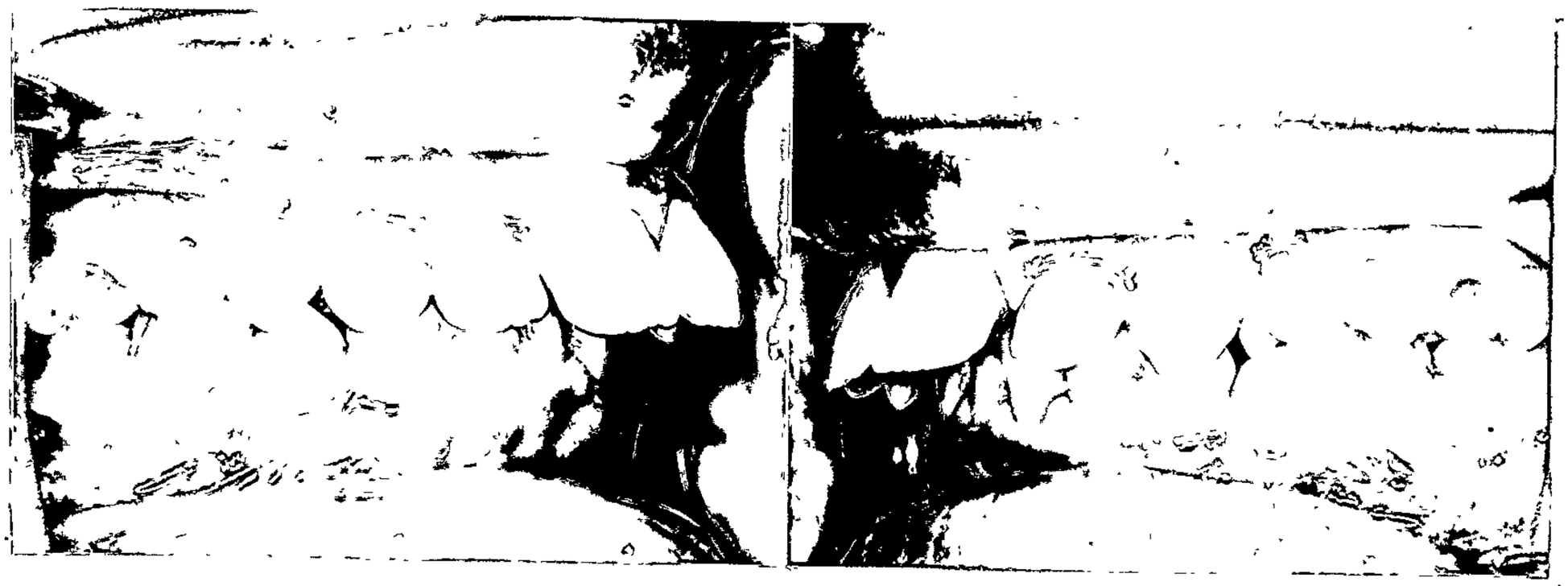
D.O.B. 24-11-65

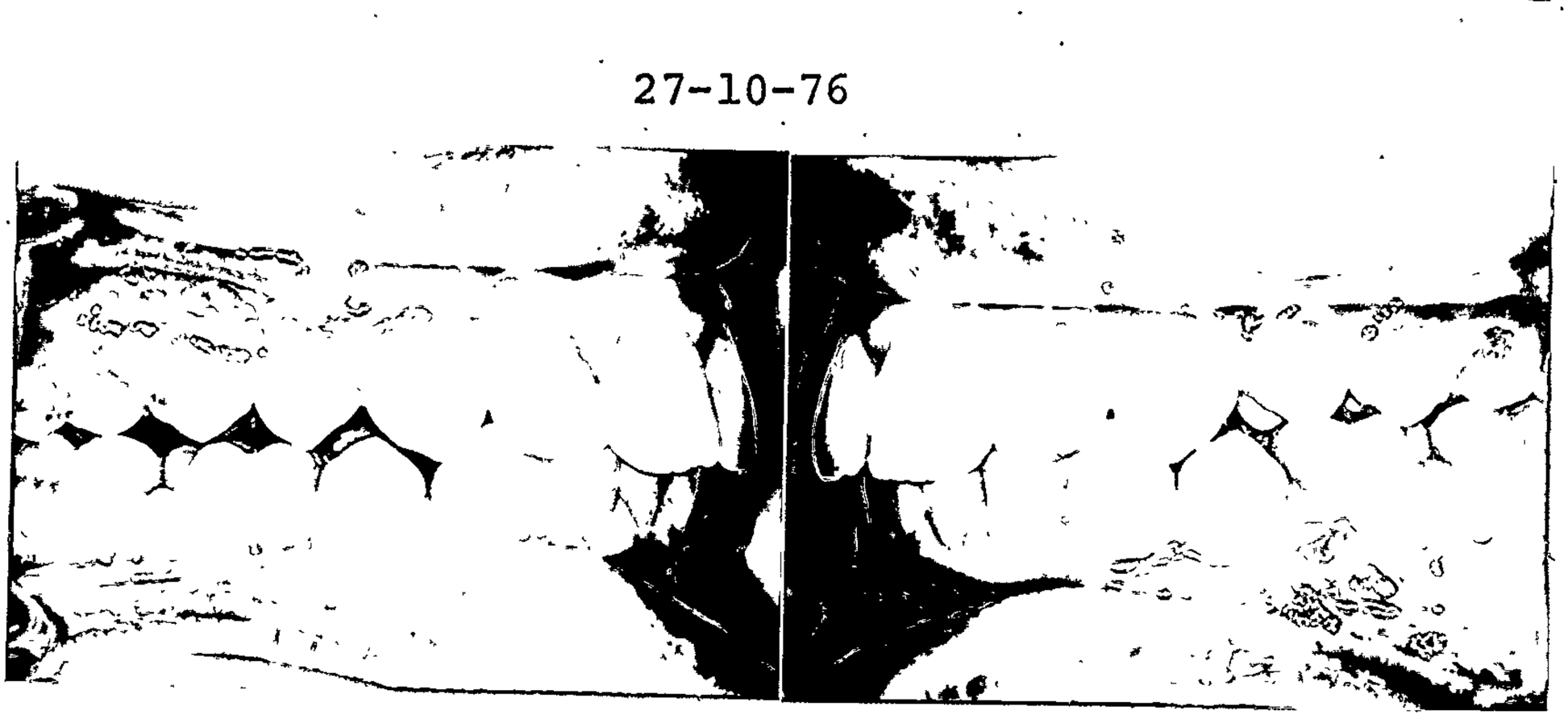
Circumpubertal

Class 11 Division 1, Full cusp right side, ½ cusp left side.

O.B. 3 mm, O.J. 11 mm.

Lips apart posture. $\frac{\quad / \quad}{E \ / \ E}$ still present. Adequate arch length. Lower centre shift to left. Lower lip inside upper incisors. Slight upper spacing. Mild lower crowding.





27-10-76

18-3-77

P.K.

Treatment Notes

29-9-76	Exam. Records.
27-10-76	Impressions.
17-11-76	Start activator and bite plate.
23-11-76	Obvious change. O.B. O.J. reduction.
10-2-77	Prefers activator. Using almost full time.
18-3-77	Considerable change. Records. Reduce activator time to afternoon and nights.
1-4-77	Records.
10-5-77	Ref. for extraction $\frac{\quad}{E / E}$. Use activator sleeptime only.

27-10-76

18-3-77

5-7-77 Continue sleeptime use.

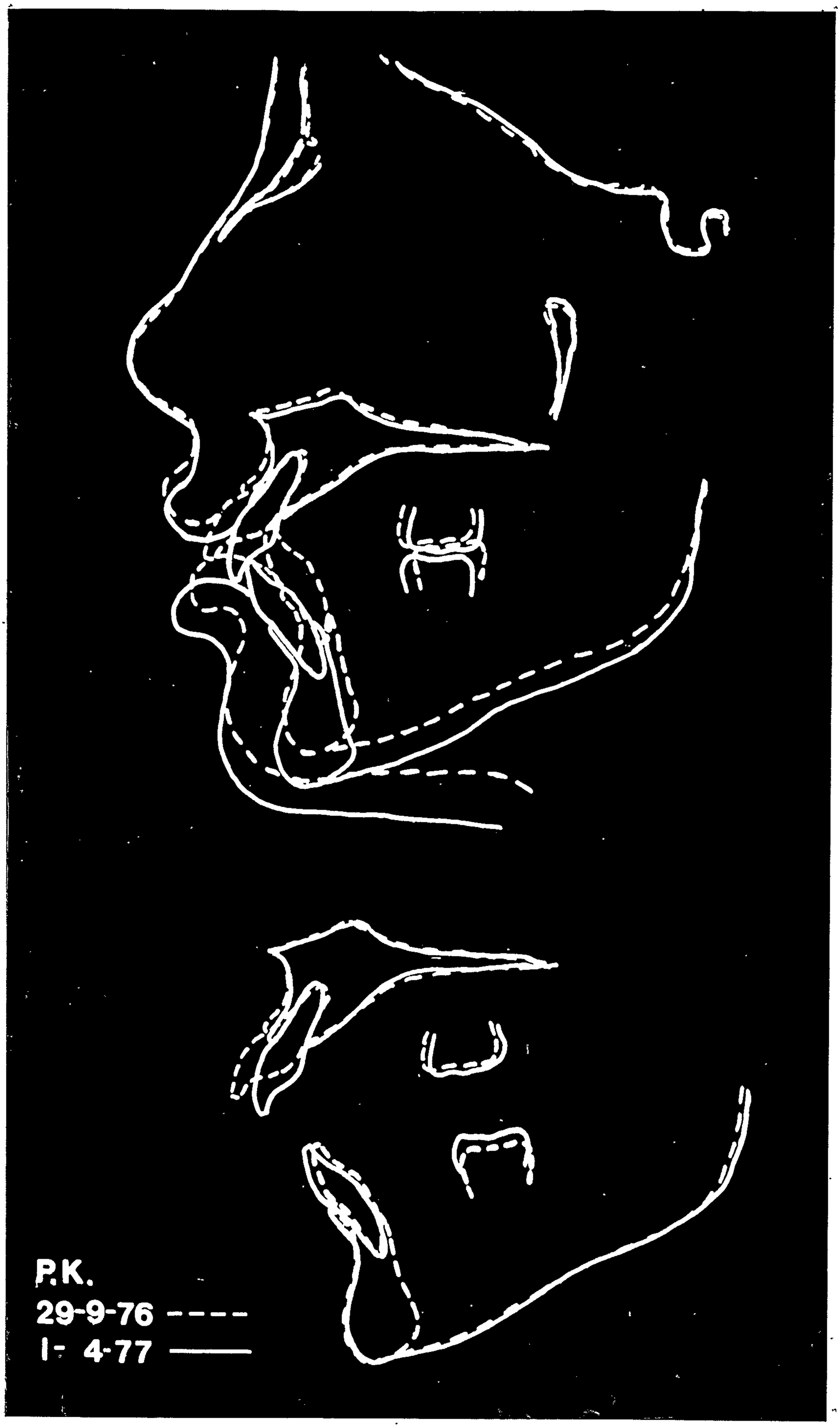
Anticipate phasing out retention over next 6 months.

Working Bite

P.K.

Treatment Summary

1. Patient chose to use the activator almost full time.
2. This produced rapid changes.
3. Allowed early progression into the reduced wearing time, retention stage of treatment.


P.K.
29-9-76 ----
I- 4-77 ——

P.K.

Treatment Summary

Measurement	Before 9-76.	After 4-77.	Change 7 months
S.N.Pg.^{0}	78.5	79	0.5
Y Axis	66.5	67.5	1
M.P. to S.N.^{0}	34	36	2
S.N.A.^{0}	84	82.5	-1.5
A.N.B.^{0}	7	5.5	-1.5
$\underline{1}$ to S.N.^{0}	120	103	-17
$\underline{1}$ to A.Pg. mm	11.5	8	-3.5
$\overline{1}$ to M.P.^{0}	95.5	100.5	5
$\overline{1}$ to A.Pg. mm	0	6	6
$\underline{1}$ to $\overline{1}^0$	110.5	120.5	10
O.P. to M.P.^{0}	15.5	15	-0.5
A.N.S., Gm. mm	60	64	4

1. Increased vertical dimension.
2. Incisor angulation changes.
3. Possible A.N.B. reduction.
4. Improved lip posture.
5. Upper incisors inside but may not be contained by lower lip.
6. Little growth increment.
7. Anticipate sleeptime retention for further 6 months.
8. Maintain 6 monthly observation.

6-4-76

12-7-77

Patient Details

C.T. Male

D.O.B. 3-7-62

Circumpubertal

1976

Full Cusp Class 11 Division 1.

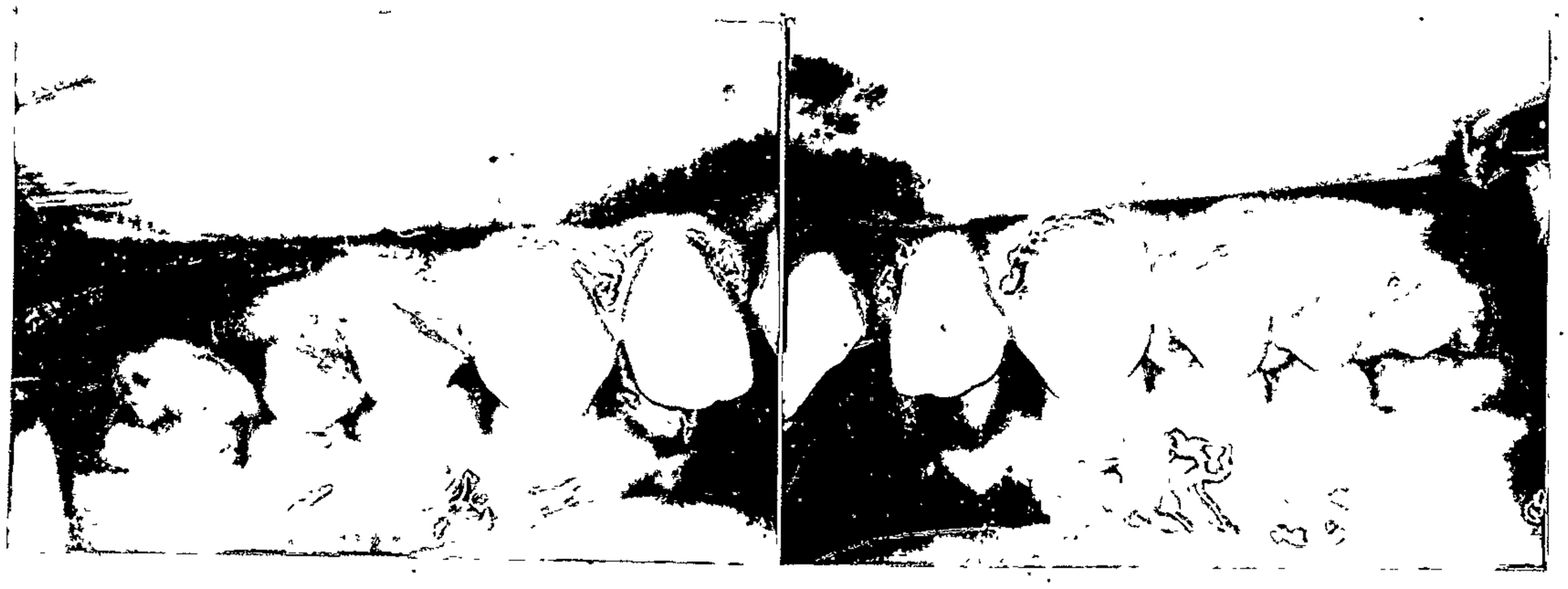
O.B. 8 mm. O.J. 11 mm.

Lips constantly apart.

Lower lip inside upper incisors.

Reduced lower face height.

Retruded appearance of lower jaw. Well developed chin point. MX and MD mild spacing. $\frac{\quad}{4/4}$ contained within MX arch. Minor speech articulation defect.



6-4-76

12-7-77

C.T.

Treatment Notes

6-3-76	Exam. Records.
28-3-76	Impression and bite registration.
4-5-76	Insert activator.
25-5-76	Replace broken labial bow.
15-6-76	Acrylic broken.
17-6-76	Repaired appliance reissued.
20-7-76	Posterior open bite. Records.
31-8-76	Reports day and night wear.
28-9-76	Thumb joint X ray. Trim to allow clearance of lower buccal teeth.

6-4-76

12-7-77

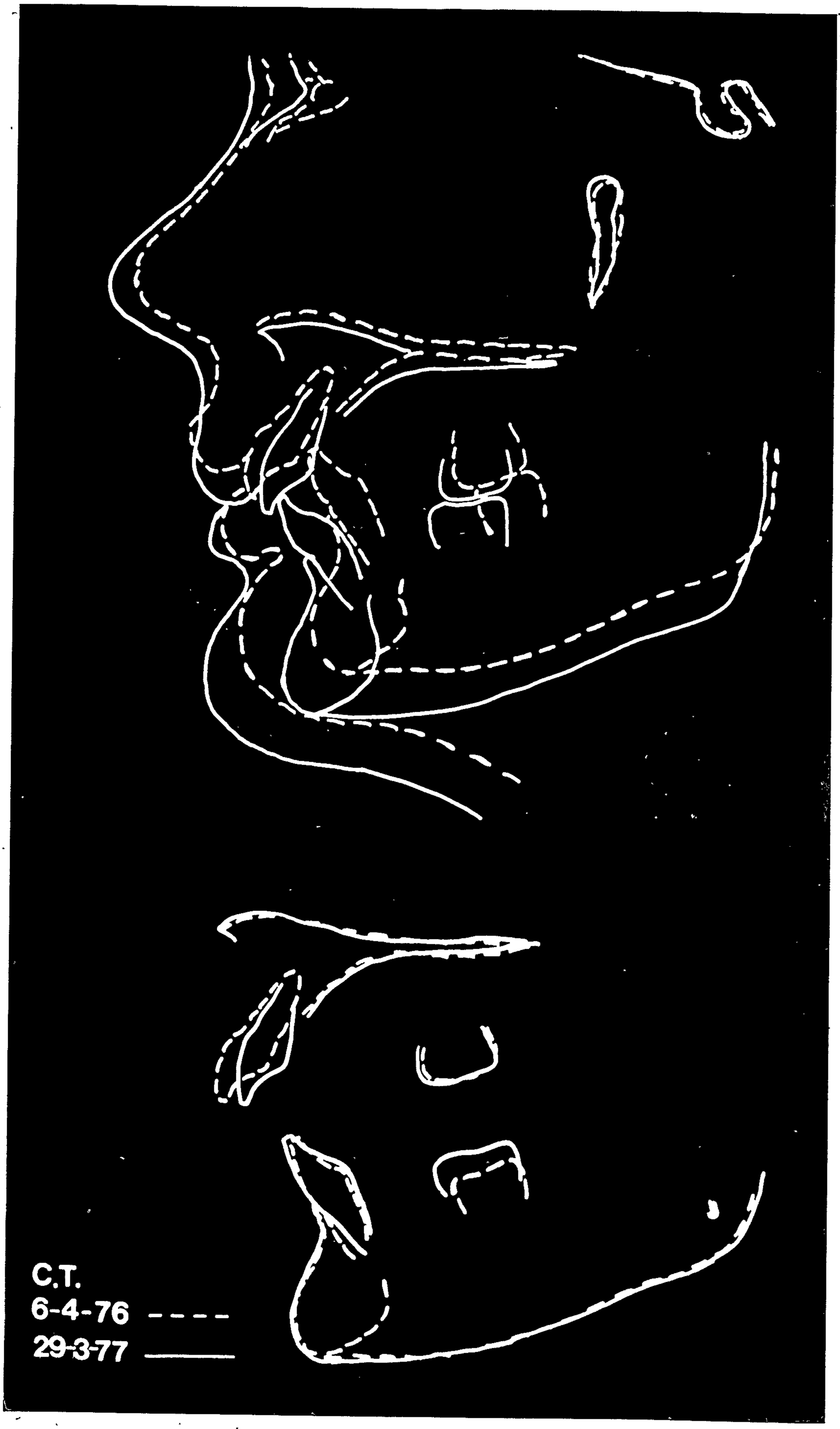
26-10-76	Buccal open bite closing. Wear night only.
23-11-76	Buccal open bite closing. Wear sleeptime only.
9-2-77	Reports appliance displaced while sleeping. Impressions.
17-2-77	Insert new activator. Wear as retainer night only.
29-3-77	Lat. ceph. Continue night retention.
10-5-77	Use alternate nights. Speech improved.
12-7-77	Continue alternate night use. Records. Anticipate phasing out retention over next 6 months. Observe developing dentition.

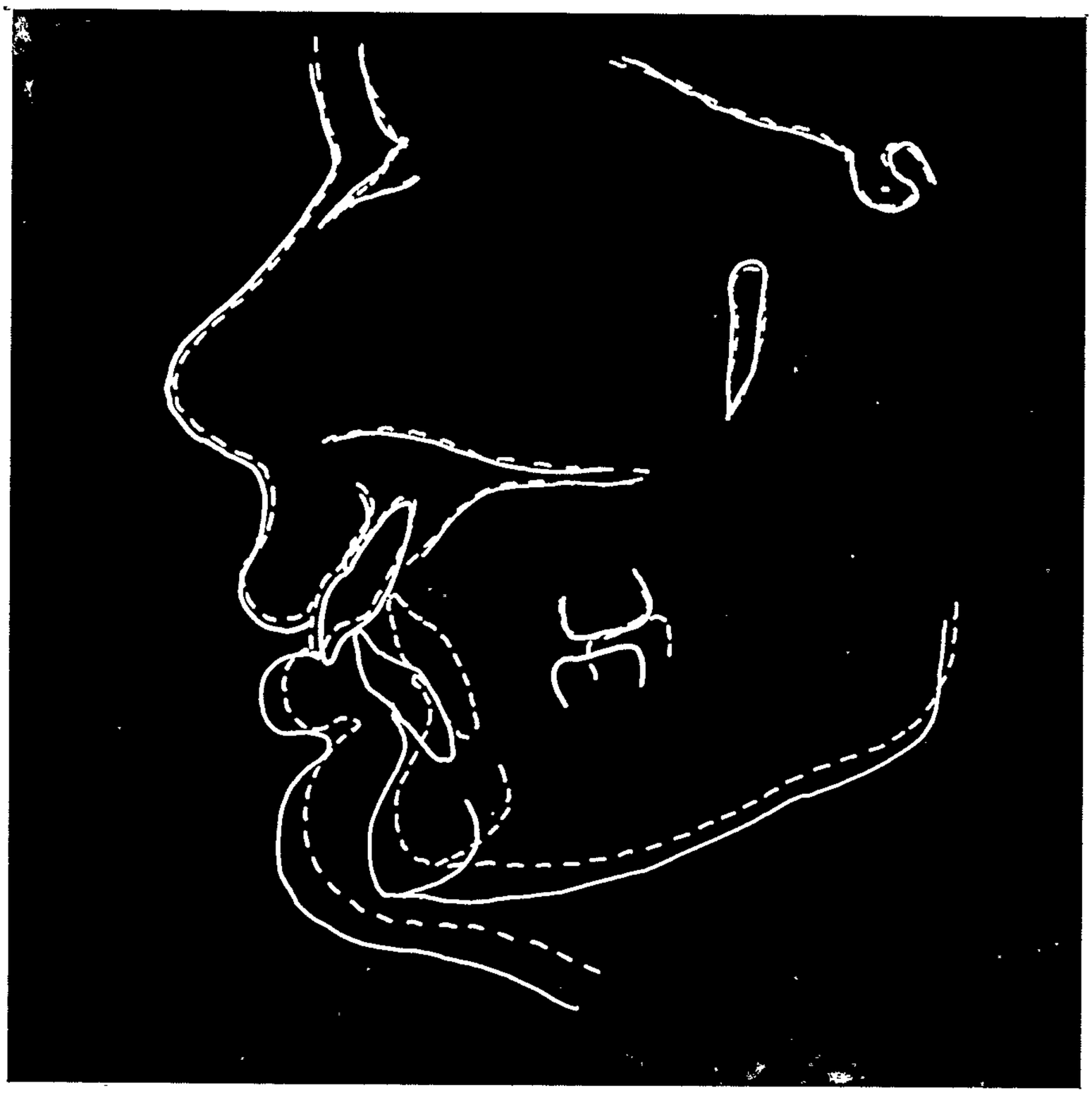
Working Bite

C.T.

Treatment Summary

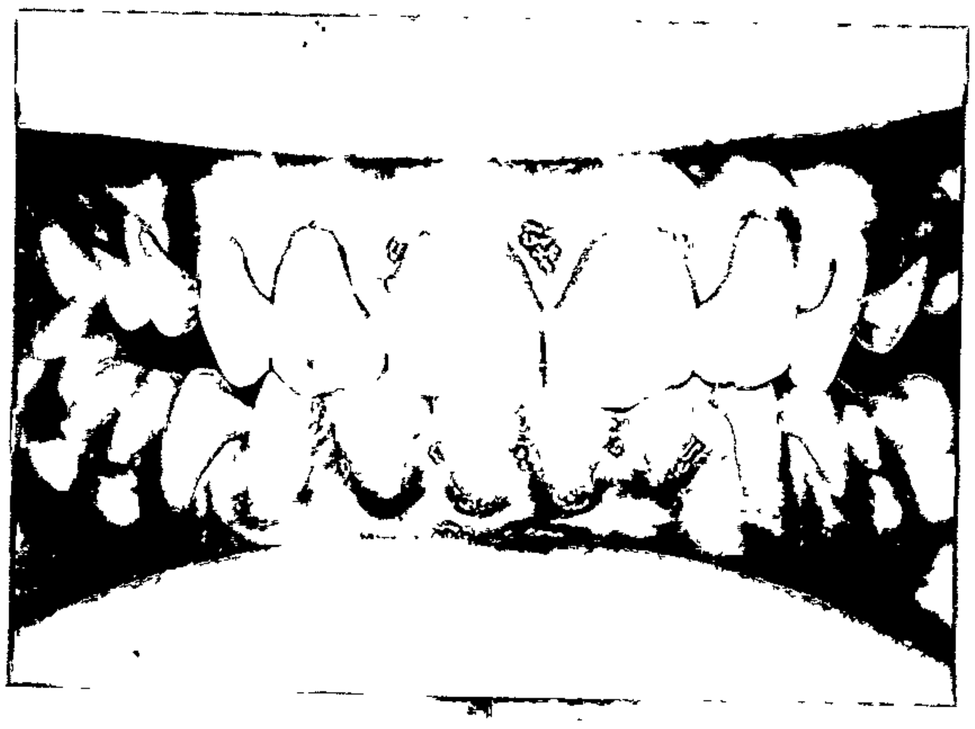
1. Appliance breakages causing delays.
2. Rapid progress with full time wear.
3. Development of buccal open bite.
4. Trimming to allow eruption of lower buccal teeth.
5. Second appliance with reduced working bite and reduced wearing time.
6. Speech improved.

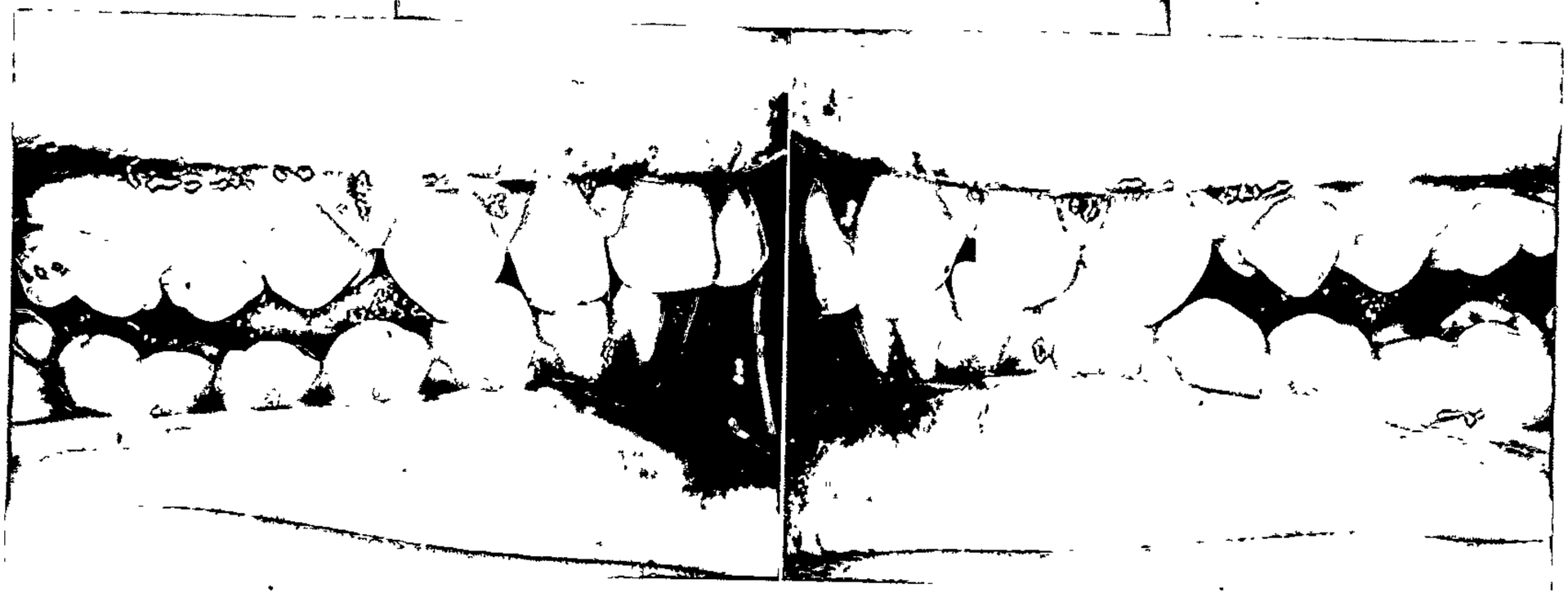

C.T.
6-4-76 - - - -
29-3-77 ——



C.T. 6-4-76---

C.T. 31-8-76 ——





C.T. 31-8-76

C.T.

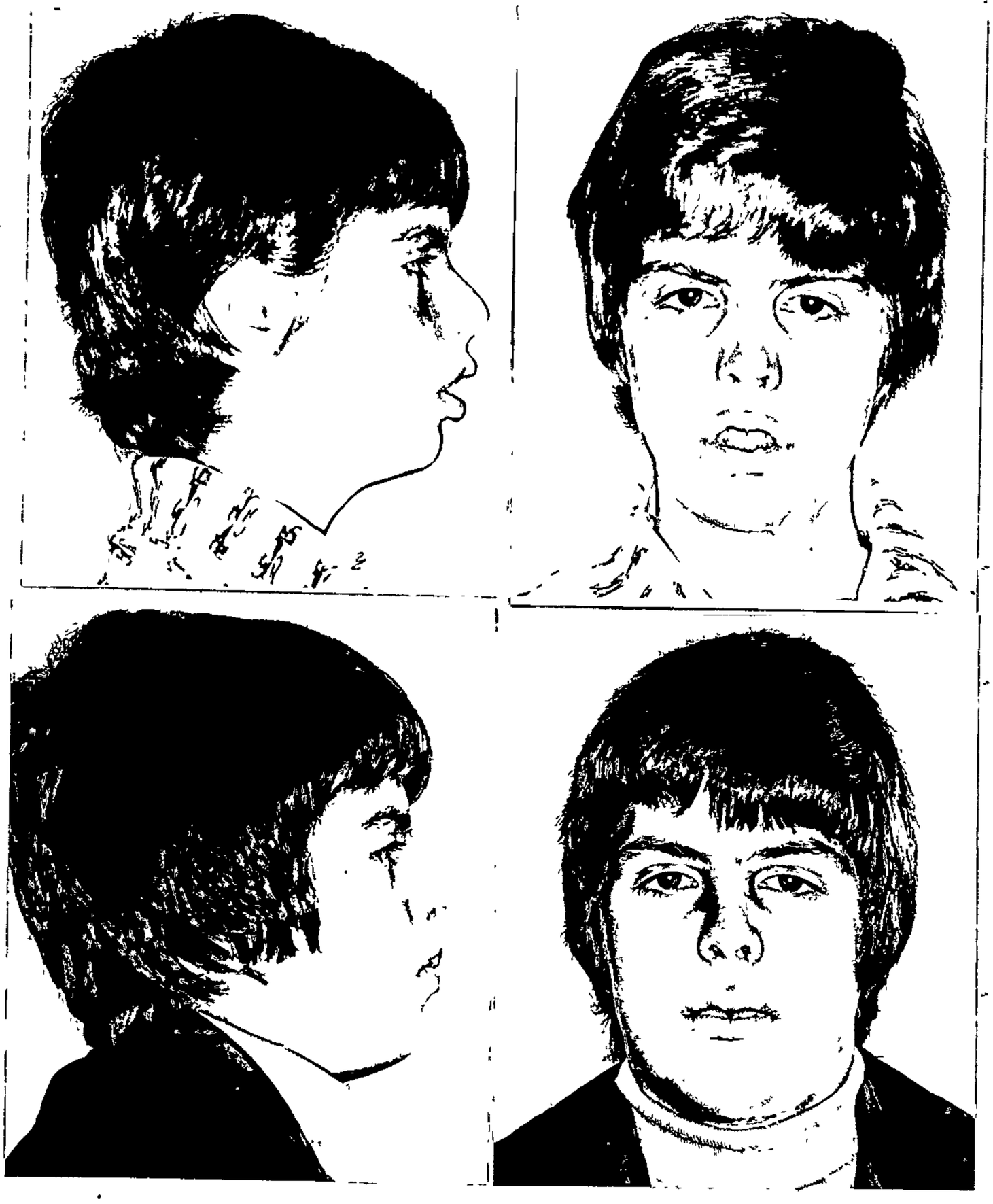
Treatment Analysis

Measurement	Before 4-76	After 3-77	Change 11 months
S.N., Pg.^{0}	86	88	2
Y Axis	58	58.5	0.5
M.P. to S.N.^{0}	19	18.5	-0.5
S.N.A.^{0}	90	88.5	-1.5
A.N.B.^{0}	7.5	3.5	-4
$\underline{1}$ to S.N.^{0}	118	109	-9
$\underline{1}$ to A.Pg. mm	11.5	4	-7.5
$\overline{1}$ to M.P.^{0}	105	112	7
$\overline{1}$ to A.Pg. mm	-2	2	4
$\underline{1}$ to $\overline{1}^0$	117.5	121	3.5
O.P. to M.P.^{0}	11	9.5	1.5
A.N.S., Gn. mm	62.5	69	6.5

1. The rapid development of the buccal open bite and Class 1 occlusion suggests condylar repositioning.
2. Large pubertal growth increment.
3. Incisor angulation change.
4. Vertical dimension increase.
5. Forward eruption of lower molars.
6. Anticipate phasing out of retention over next 6 months.

7. No further treatment planned. 6 monthly observations.

15-2-77



8-6-77

Patient Details

C.S. Male

D.O.B. 6-11-65

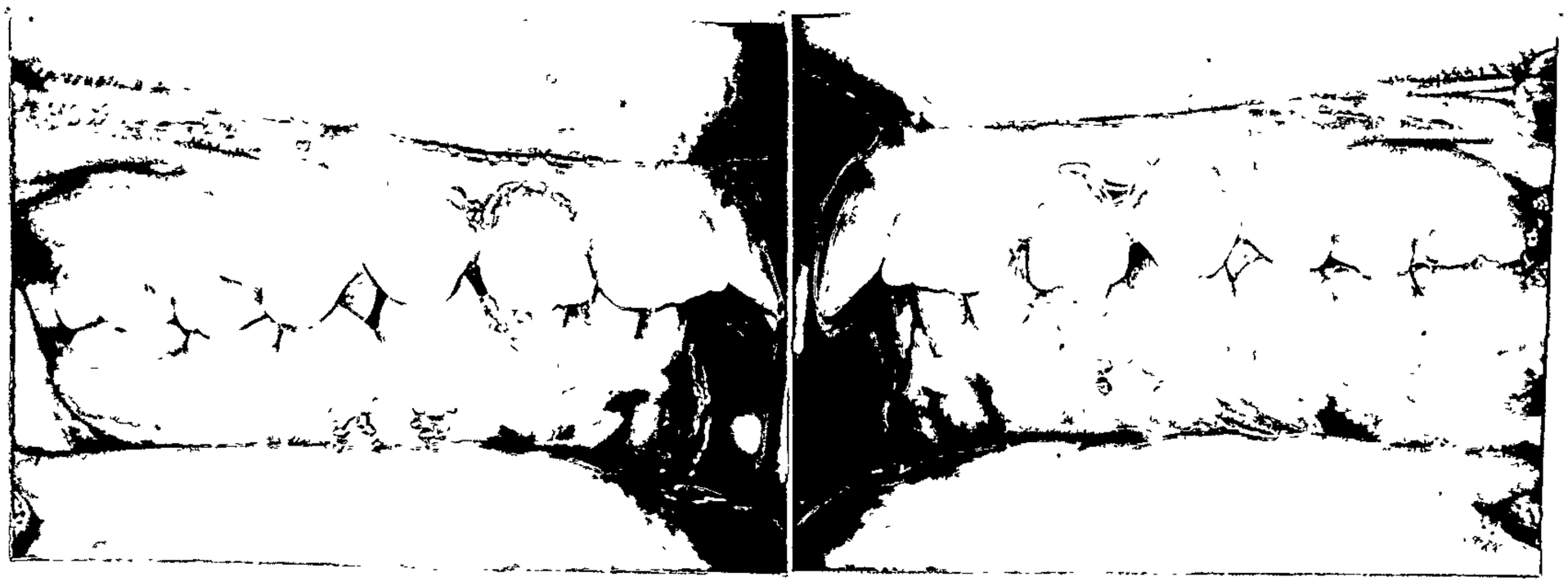
Prepubertal

Half Cusp Class 11 Divisionl

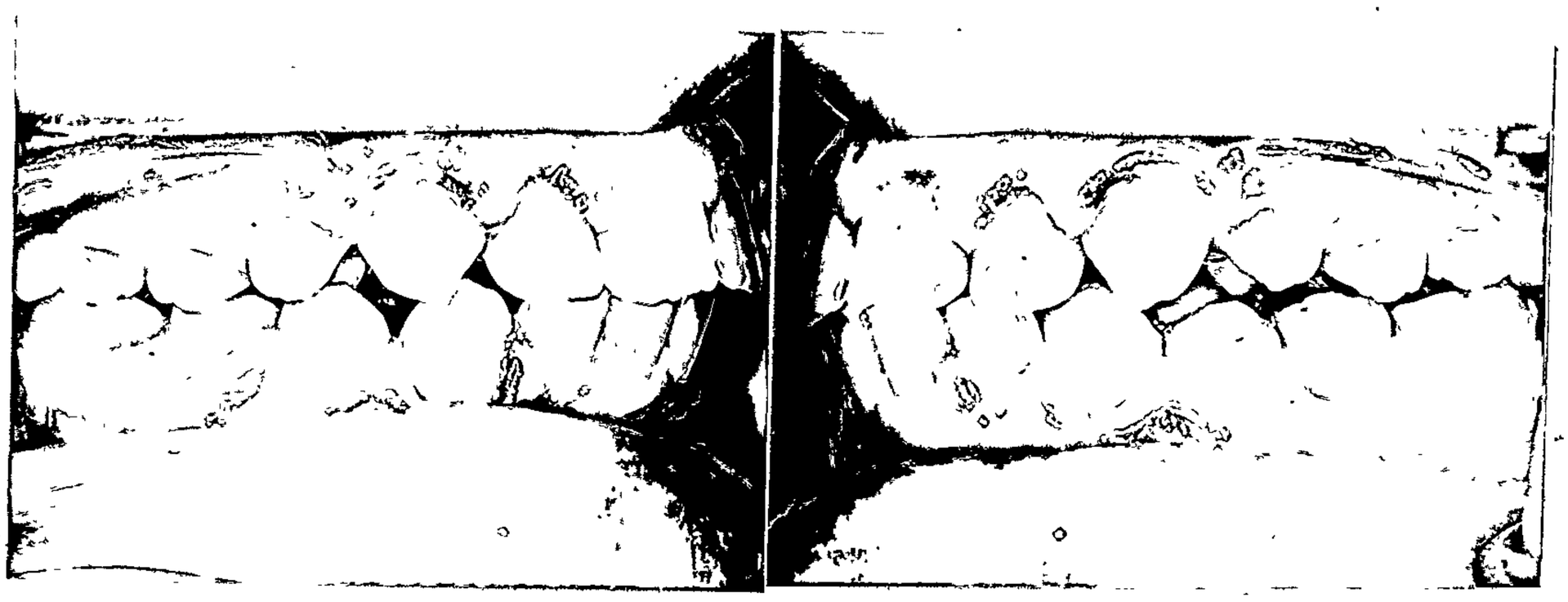
O.B. 3 mm O.J. 8 mm.

Lips constantly apart.

Slight upper arch spacing.



15-2-77



8-6-77

C.S.

Treatment Notes

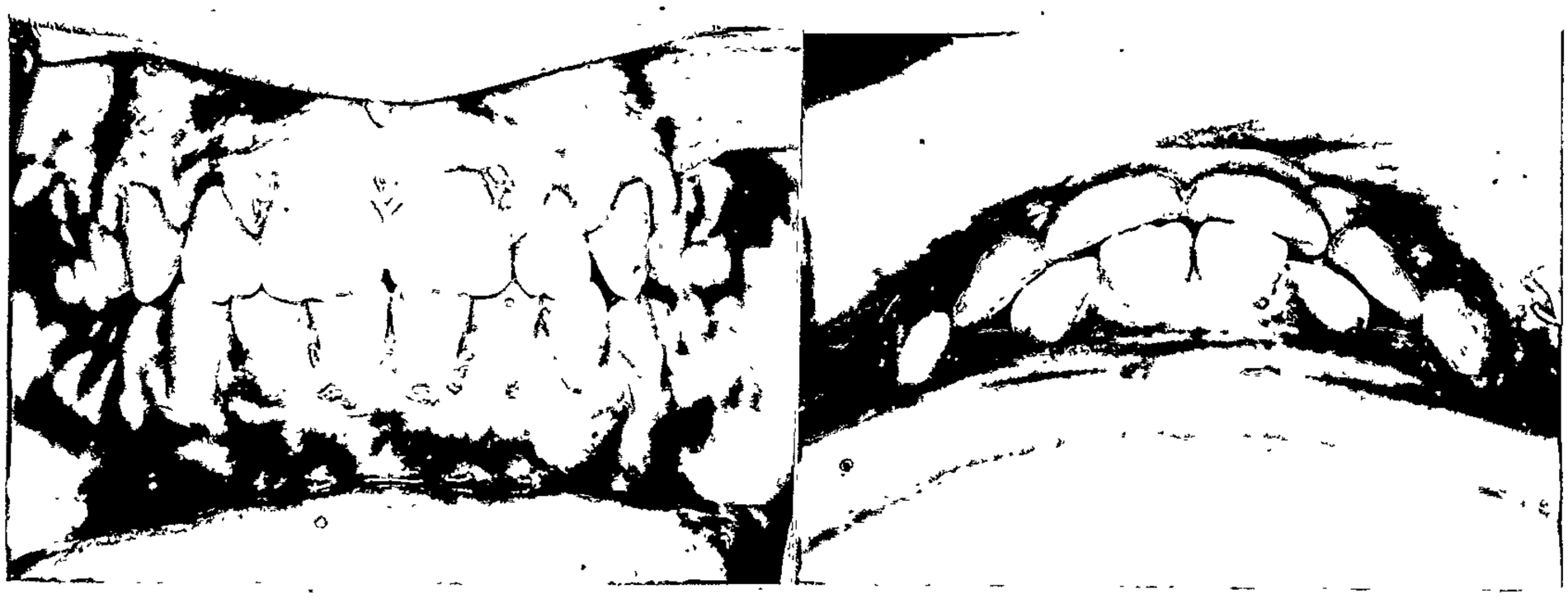
15-2-77 Exam. Records. Impression.

10-3-77 Start activator and bite plate. Requested to wear bite plate when unable to use activator. Cephs. and thumb joint X rays.

17-3-77 Sesmoid adductor not present. Patient says he is using activator at night, bite plate in the day.

9-4-77 Patient not wearing appliances. No changes Advised to take treatment seriously or accept condition as is.

15-2-77



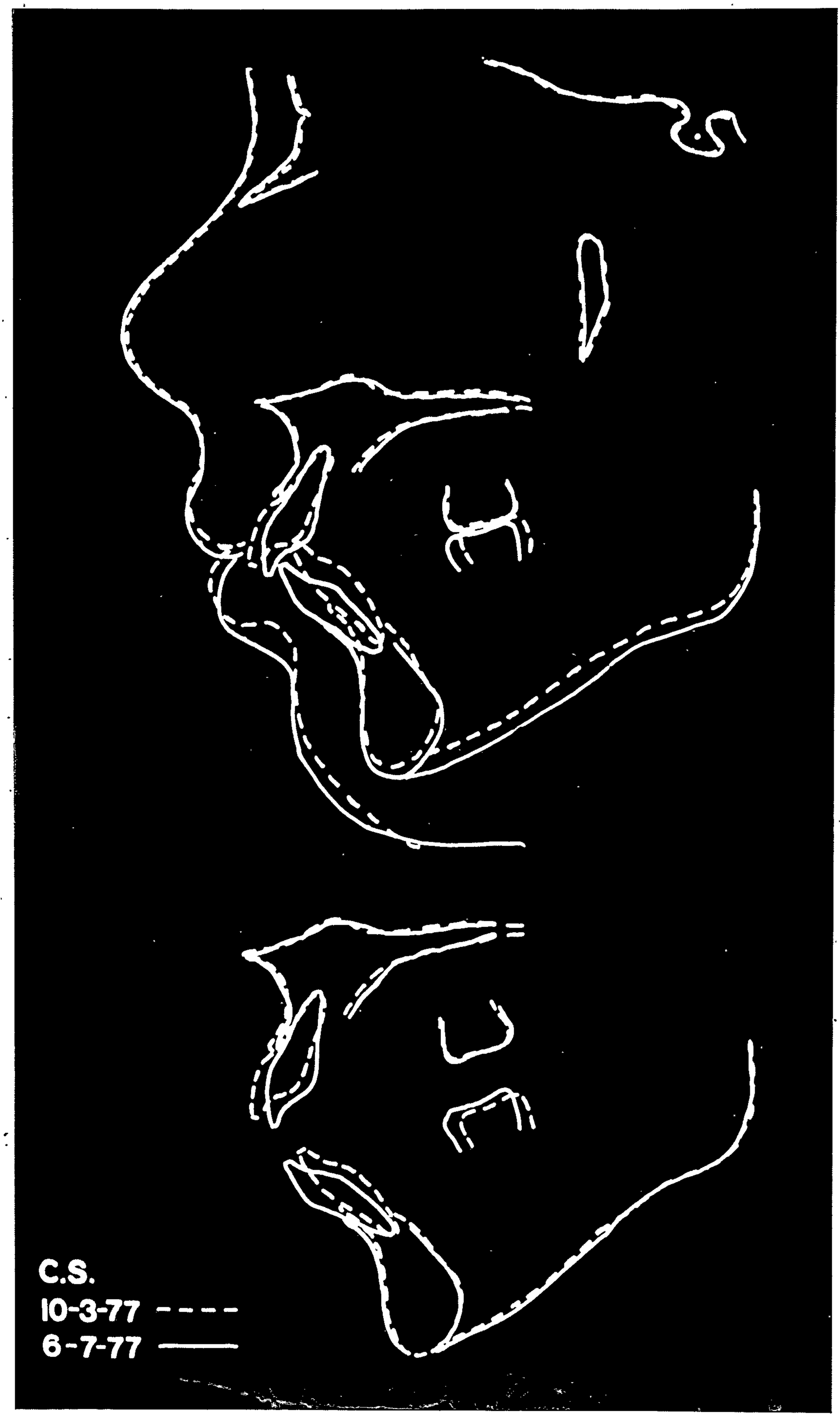
6-7-77

20-5-77	Improved effort. Now using activator almost full time.
8-6-77	Effort being maintained.
6-7-77	Records
18-10-77	Sleeptime wear only.

Working Bite

Treatment Summary

1. Little initial effort by patient.
2. When patient responded he chose full time activator.
3. Patient noticed and is pleased with the changes he has caused.


C.S.
10-3-77 - - - -
6-7-77 ——

C.S.

Treatment Analysis

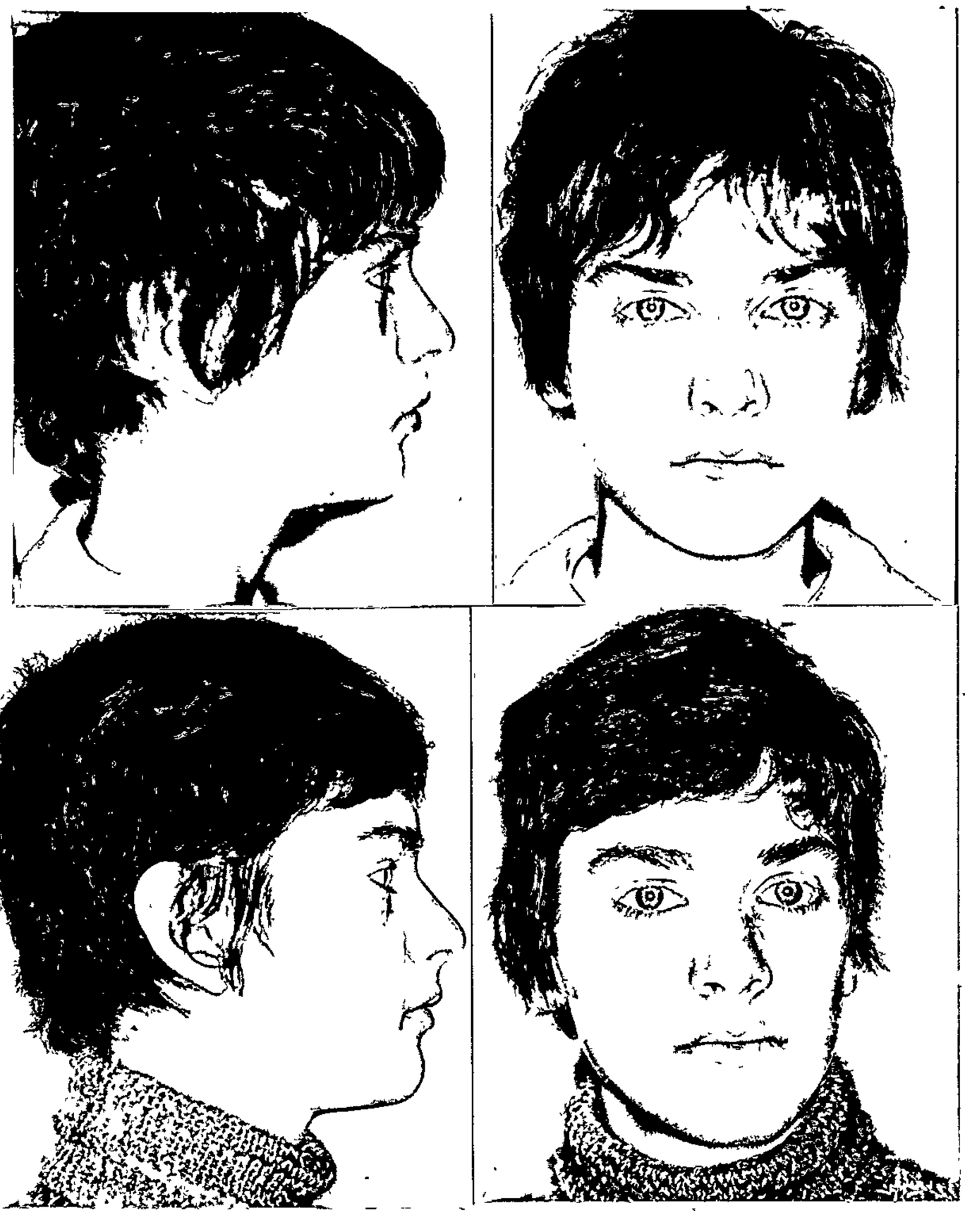
Measurement	Before 3-77	After 7-77	Change 4 months
S.N., Pg.^{0}	82	83.5	1.5
Y Axis	65.5	66	0.5
M.P. to S.N.^{0}	29	29	0
S.N.A.^{0}	88.5	88.5	0
A.N.B.^{0}	8	7	-1
$\underline{1}$ to S.N.^{0}	121.5	113	-8.5
$\underline{1}$ to S.Pg. mm	12	10	-2
$\overline{I}$ to M.P.^{0}	106.5	114	7.5
$\overline{I}$ to A.Pg. mm	3.5	6	3.5
$\underline{1}$ to $\overline{I}^0$	102.5	103	1.5
O.P. to M.P.^{0}	15.5	13.5	-2
A.N.S., Gn. mm	68	71	3

1. Considerable improvement in lip posture.
2. Incisor angulation changes.
3. Left side Class 1 relationship achieved.
4. Right side approaching Class 1 relationship.
5. Overjet, overbite reduction.
6. Increased vertical dimension.
7. Small growth increment.
8. Forward eruption of lower molars.

9. Little or no forward movement of upper molars.

10. Anticipate continuing activator full time for 3 months. Then retention and observation.

3-9-76



15-8-77

Patient Details

S.P. Male

D.O.B. 23-5-64

Prepubertal

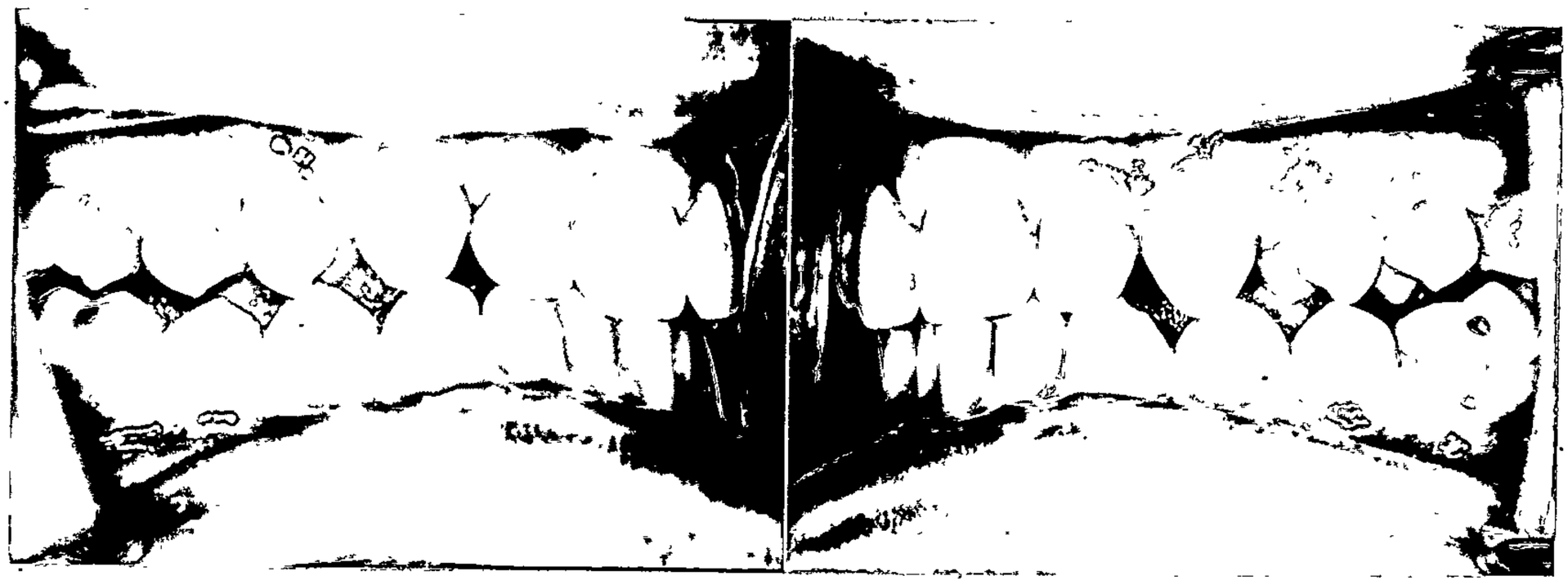
Class 1 with deep bite*

Lower centre line shift to right.

Competent lips with good facial contours.

* This Class 1 Case was included to demonstrate Bite Opening.

3-9-76



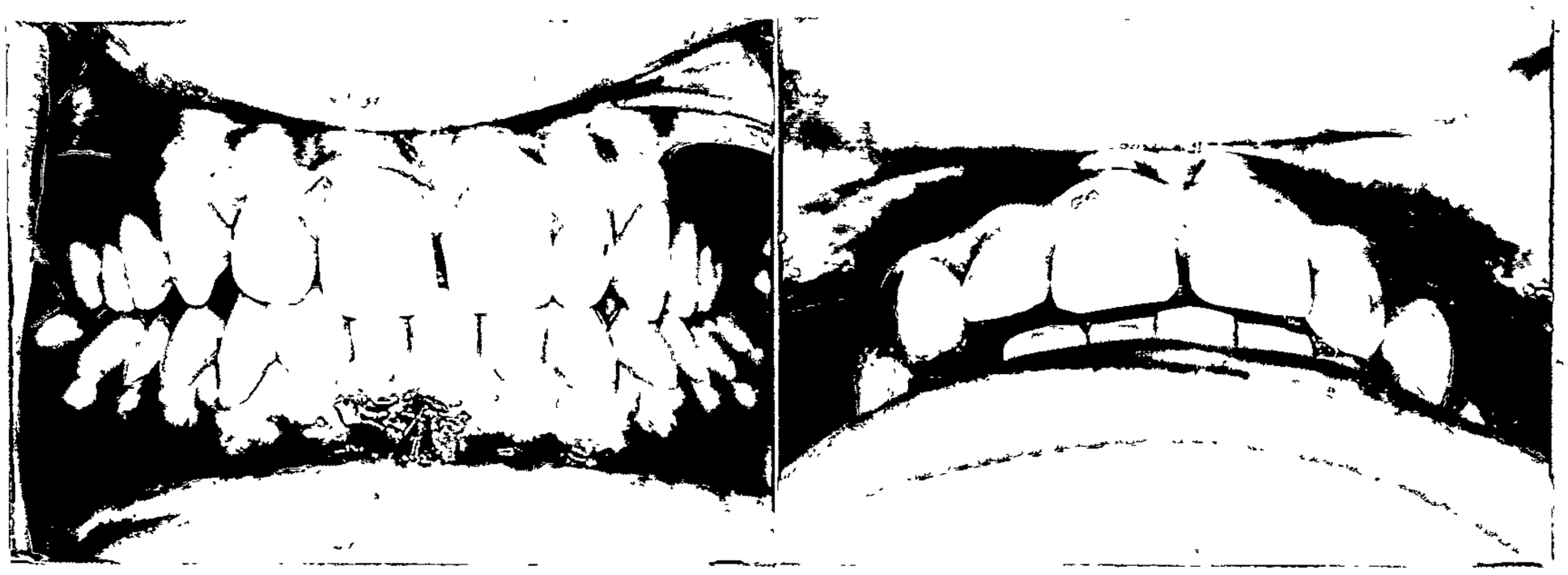
15-8-77

S.P.

Treatment Notes

3-9-76	Records, impressions.
28.9.76	Start bite plate full time
19-10-76	Start activator. Use bite plate when unable to use activator.
28-10-76	Trim lower buccal acrylic free of teeth.
30-11-76	Using bite plate all day. Activator at night.
16-3-77	Records. Buccal open bite. Impressions.
5-4-77	Start bite plate with springs to procline 2/2 and incline plane.
21-4-77	Continue using full time bite plate.

3-9-76



15-8-77

25-5-77 Sufficient proclination. Reduce spring force.

8-6-77 Impression for Hawley retainer with expansion screw to improve 6/7 position.

22-6-77 Retainer bite plate fitted. Expansion 6/7

4-8-77 Continue full time.

15-8-77 Buccal bite closed. Night only retention. Anticipate retain 6 months. Then maintain observation.

Working Bite

S.P.

Treatment Summary

1. Patient started with both activator and bite plate.
2. Then bite plate only.


S.P.
8-6-76- - - -
5-5-77 ——

S.P.

Treatment Analysis

Measurement	Before 6-76.	After 5-77.	Change 11 months
S.N. Pg.^{0}	79	80.5	1.5
Y Axis^0	66.5	68	1.5
M.P. to S.N.^{0}	29	31	2
S.N.A.^{0}	79.5	80.5	1
A.N.B.^{0}	2	1.5	-0.5
$\underline{1}$ to S.N.^{0}	95	99.5	4.5
$\underline{1}$ to A.Pg. mm^0	2	2	0
$\overline{1}$ to M.P.^{0}	87	89	2
$\overline{1}$ to A.Pg. mm	-1.5	0	1.5
$\underline{1}$ to $\overline{1}$	149	140	-9
O.P. to M.P.^{0}	9.5	10.5	1.
A.N.S., Gn. mm	57.5	62.	4.5

1. Small angulation change to incisors.
2. Vertical dimension increase.
3. Associated lower buccal eruption.
4. Little growth increment.

14. Reported Treatment Durations

		Number of Cases	Reported Average Duration (months)	
MASON	(1977)	8	8	*
HAUPL	(1952)	Not reported	16 - 54	
GRESHAM	(1952)	20	12	
DICKSON	(1965)	100	15	
MILLS	(1975)	5	11 - 28	
TULLEY	(1972)	6	21 - 36	
JORGENSEN	(1974)	Not reported	24 - 36	
HIRZEL and GREWE	(1974)	One (ideal)	36	
DEMISCH	(1972)	28	13.9	*
AHLGREN	(1970)	37	38	
STOCKLI and DIETRICH	(1973)	25	18	
MOSS	(1975)	One example case	23	
HARVOLD	(1974)	10	18 - 30	O

* EXCLUDING RETENTION

O INCLUDING RETENTION

OTHERS NOT STATED

5. Discussion of Results

Treatment of 6 of the 14 patients selected for this trial was unsuccessful. These 6 cases will be discussed first.

One 9 year old proved to be more of a Class II, Division 2 type. Following a sequence of lost appliances and broken appointments, it was thought best to defer treatment for the present and review the need for further treatment at a later date.

Three cases were discontinued because of lack of patient motivation and effort. One of these had previously failed to use an extra oral traction appliance.

One 16 year old girl was started because the patient did not wish to have fixed appliances. Her age, together with the small effort she made, resulted in almost no change after four months. Treatment was stopped.

One patient changed his address one month after receiving his appliances and failed to attend for further appointments.

Some of these failures may have been avoided if there had been more detailed patient/parent preparation, and discussion before treatment started. This may have resulted in some of the treatments not being commenced.

The parents or guardians of two of the cases either were unable, or chose not to attend the

clinic for discussions during the course of the attempted treatments.

Treatment of the remaining 8 patients may be considered successful. The degree of success will depend to some extend on the viewpoint of the reader.

This thesis has attempted to show some of the developments in the use of activator type orthodontic appliances. The author is aware of other more general trends and developments in orthodontic theory and practice. One must therefore attempt to discuss the results within the consensus of current orthodontic practice, if such a thing exists. If it does exist then it is probably much different now in Australia to what existed in Europe when functional appliances were developed. One difference lies in the increased availability of orthodontic services provided by clinicians better trained in the use of fixed appliances. This allows and probably requires the use of activator type appliances to be much more selective than it was in earlier years. The results obtained for some of the cases are presented to support my view that for selected cases the functional appliance approach to treatment has a definite place in current orthodontic therapy in Australia.

The question as to whether activators are suitable for use by general practitioner clinicians is theoretically easy to answer. The clinician who has sufficient knowledge of the management of the appliances together with the orthodontic diagnostic skill to

select cases which will respond, will be able to carry out such treatments successfully.

Some patients with malocclusions which would otherwise respond to this type of treatment are unable to cope with the demanding self-treatment concept. The clinician must be able to identify these patients and change the treatment program before the patient becomes disillusioned and exhausted. There are also some cases which require follow up fixed appliance therapy.

In practical terms the ful/fillment of these requirements would seem to be difficult enough for a fully trained orthodontist to satisfy.

It is for these reasons that I agree with Harvold (1974) who says that interceptive treatment should be done by those possessing the fullest available knowledge of the "evolving biodynamic system" and should "also be skilful in the use of the traditional appliances".

There is, however, the opportunity, as in many other areas of health care, for the team approach under the supervision of a fully trained leader. This requires an additional clinical administrative ability of the leader. The discussion beyond this point passes outside the limits of this thesis.

Returning to the 8 patients reported as successful treatments. 5 of the patients C.T., C.S., N.B., M.B.C., and P.K., may not need additional corrective treatment. Follow-up supervision will substantiate or

disprove this prediction. If further treatment is not required then interceptive functional treatment alone was all that was necessary to produce an acceptable occlusion.

This may be the case for 5 out of 14 of this selected group of patients. The proportion of the total orthodontic patient population which would have the indications for, and show a similar response to such treatment, would be much less.

Of the other 3 cases - 1 may benefit from, and 2 may in the future, require further treatment.

Some of the more clinical details of the cases will now be discussed.

The two features of the occlusion most often used as indicators of orthodontic movements are the incisor relationship and the molar relationship.

All of the cases showed a decrease in the overbite/overjet relationship. All of the Class II, Division I cases showed an increase in the interincisal angle. This was due to a combination of upper incisor retraction and lower incisor protrusion. The stability of the altered interincisal relationship for some of the cases is uncertain.

All cases show an altered molar relationship. This has been caused by restricting the forward eruption of the upper molars and aiding the forward eruption of the lower molars. All cases show an increased vertical dimension. All of the cases show a decreased occlusal plane to mandibular plane angle. Forward repositioning

of the mandible may have occurred in two cases (C.T.) (G.H.).

There seemed to be improvement in lip competence in most of the cases. More refined and standardised methods would have to be used to measure these facial soft tissue changes.

Some of the molar relationship changes were influenced by the loss of deciduous molars. When allowance is made for this leeway adjustment, three cases - C.T., M.B.C., and P.K. showed the largest antero-posterior molar relationship change. These three cases were all circumpubertal. They also showed the largest vertical dimension increase. These observations support the Harvold-Vargervik (1971) findings, relating vertical change to antero-posterior relationship.

The average duration of active treatment time required to produce the results shown was 8 months. This must not be considered as total treatment time as some of the cases (M.B.C., C.S.,) are still in active treatment. The rest are in various stages of retention. Some will probably require later periods of fixed appliance therapy.

The results obtained would seem to compare favourably with other reported cases. Comparisons should be made with caution because of the difficulty of determining daily wearing time, duration of retention, and treatment objectives. Tulley (1972) for example, included extraction cases and Dickson

(1965) routinely used a centreline Coffin spring for arch expansion.

Wearing Time Record

Brief mention must be made concerning the keeping of wearing time records by patients. Various designs of time sheets were tried. The requirement is for a layout design which is simple and quick for the child to use. The time sheet concept must be presented to the patient as an aid for them to use in their management of their treatment problem. Patients were requested to present their time sheet record for discussion at each visit. Most did.

At each visit, progress or lack of it would be demonstrated and discussed. The amount of progress would be related to the time sheet record. At the first time sheet discussion I would point out how easy it is to falsify the time sheet record and how the patient would soon notice that progress was related to the actual wearing time which only he knew about, and not to any false record he presented. The patients ability to contribute to these discussions is a reliable guide to the patients ability to handle the self-treatment concept.

When an acceptable wearing time pattern was established the time sheet discussions were phased out unless they were initiated by the patient or parent. This sometimes occurred when the patients daily activity pattern altered because of school holidays, or periods of illness.

Once patients understood the requirements and were progressing at a satisfactory rate they were encouraged to plan and practice sufficient flexibility in their daily program to minimise the inconvenience and stress of the treatment.

Selection of Class II, Division I Cases

1. The patient must be sufficiently motivated to accept the self-treatment concept. Some patient and parent preparation is usually necessary.
2. Arch lengths must be adequate and preferably slightly excessive.
3. Some proclination of lower incisors must be expected. If this is unacceptable other forms of treatment should be used.
4. Increase in vertical dimension will occur. Cases for which this is contraindicated should be treated by other means.
5. If detailed individual tooth movements are required, fixed appliances are indicated.
6. If obvious changes are not produced in three months the appliances are not being used as requested. Treatment should be stopped or other appliances used.

The role of the parent is most important. They must understand the self-treatment concept and should be requested to give understanding, encouragement and support. Clinicians must be watchful for those parents who adopt a nagging and even punitive roll. Tact and

persuasion is often necessary to direct the parent to adopt an essentially supportive role to the primary clinician/patient relationship. The essential clinician/patient relationship may take a little time to develop before the appliances are issued. It must be encouraged at all times during treatment with the patient being made to feel responsible for progress.

Discussion of Appliances

The use of the activator - bite plate combination has certain advantages over the activator-only method.

1. Full time appliance usage with a minimum of twelve hours activator daily will produce rapid orthodontic change.
2. The rapid changes, when seen by the patient, may be presented as a motivation stimulus to achieve extra activator usage and an even faster rate of change.
3. Additional, and even full-time activator use, should be suggested and encouraged. The use of the bite plate allows the patient some flexibility in determining his/her own self-treatment program.

16. Suggestions for Further Investigations

This author has gained the clinical impression that some Class II cases have the condyles in an abnormally distal position within the temporo-mandibular joint. This is not a new concept. (Levy 1975) Identification of these cases at the start of treatment would considerably aid treatment planning for both activator and fixed appliance cases. Cases which have a distal mandibular movement from centric relationship to centric occlusion may be of this type. Investigation of this is required.

A second area of clinical investigation is the simultaneous use of activators with fixed appliances. A suitable combination method would allow utilization of the benefits of both appliances. Such a system would have some effects similar to the Oliver Guide Plane Method. (1962)

17. Summary and Conclusion

A review of the available literature concerning the clinical application of activator appliances has been presented. Three different trends in appliance design have been identified.

Trend One relates to the development of reduced bulk continuous use appliances. This type has much of the acrylic replaced by wire connecting units. This allows easier speech, breathing and hopefully engenders greater acceptance of the therapy. The inbuilt shock absorbing of the wire connectors is claimed to stimulate muscle activity. This is thought to promote more rapid tooth movement and muscle adaptation.

The Second Trend, developed and advocated by Harvold, Woodside and others - concerns an appliance, mainly of acrylic, with increased vertical dimension to produce maximum muscle stretch stimulation. Occlusal changes are produced by controlling the antero-posterior movement of teeth within the increased vertical dimension of the mouth.

The Third Trend, as advocated by Herren and Demisch developed as a horizontal stretch appliance with a forwardly over compensated working bite. This type requires additional retention in the form of clasps applied to some of the upper buccal teeth. When sufficient occlusal change has been achieved a retention activator with reduced forward mandibular protrusion is used. Airways are not provided.

Each activator used in this study was of the basic Andresen Haupl type. They were modified in the way described to incorporate the author's choice of the most advantageous features of the three current general design trends.

These were:

1. an airway.
2. sufficient vertical dimension to allow control of the buccal segments without exceeding the tolerance of the patient.
3. a maximum but comfortable working bite protrusion. The need for retention clasps may indicate that the comfortable limit of protrusion has been exceeded.

The appliances were varied slightly to fit individual requirements, in line with Harvold's concept of a specific design for a particular malocclusion.

The use of a bite plate, when the activator cannot be worn, maintains some of the activator functions almost full time and may be an important factor in reducing treatment times.

Successful results were obtained for 8 of the 14 cases selected for treatment. Analysis of the failures shows the importance of restricting the use of this method of treatment to motivated patients with Class II malocclusions of the type which respond to the method.

Selection of patients for activator treatment is necessary, the following factors being taken into account as far as possible.

Class II Division I malocclusions offer best prospects for successful treatment. These malocclusions should be associated with good dental arch form without crowding. There should be neither proclination of mandibular incisors nor vertically long anterior face height. Both these latter traits are likely to be somewhat accentuated with activator treatment. The age of the patient is important in terms of treatment comprehension, motivation and overall treatment plan. Timing to co-incide with peak growth velocity is an advantage. Observation and retention - if necessary should be maintained until growth is completed.

The occlusal changes, and the treatment times, compared favourably with other studies.

The activator appliance is useful in attaining certain treatment objectives for particular types of Class II Division I malocclusion. The effectiveness of the method is increased if the daily wearing time is increased and/or it is combined with the use of a maxillary bite plate.

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