8-1992

A Pilot Study on the Evaluation of Short Term Effects of Jasper Jumper Therapy

Eric D. Fraser

ABSTRACT

A PILOT STUDY ON THE
EVALUATION OF SHORT TERM EFFECTS
OF JASPER JUMPER THERAPY

by

Eric D. Fraser, D.D.S.

Lateral cephalometric radiographs were obtained for ten patients treated with Jasper Jumper appliances from three locations. Pre and post-appliance measurements were compared to determine the cephalometric effects seen in this group of patients. All patients in this study exhibited mesofacial to brachyfacial growth patterns and were all of growing age. All patients were treated to Class I along the complete buccal segment. The results yielded the following conclusions: 1) the facial axis did not open and the lower face height did not increase significantly for this group of patients, 2) there is an intrusive effect delivered to the upper first molars, 3) superimpositions revealed efficient orthodontic movement of the upper first molar with some advancement and minor flaring of the lower incisor, 4) possible orthopedic and functional effects were demonstrated by tipping of the palatal plane and an increase in the facial depth beyond normal growth increases.

LOMA LINDA UNIVERSITY

Graduate School

A PILOT STUDY ON THE

EVALUATION OF SHORT TERM EFFECTS

OF JASPER JUMPER THERAPY

by

Eric D. Fraser, D.D.S.

A Thesis in Partial Fulfillment

of the Requirements for the Degree Master of Science

in Orthodontics

August 1992

Each person whose signature appears below certifies that this thesis, in his opinion, is adequate in scope and quality as a thesis for the degree Master of Science.

______________________________, Chairman
Daniel A. Flores, Assistant Professor of Orthodontics

____
Joseph M. Caruso, Chairman and Program Director
Department of Orthodontics

____
Michael J. Fillman, Assistant Professor of Orthodontics

____
Bruce S. Heinrich, Assistant Professor of Orthodontics

ACKNOWLEDGEMENTS

I would like to thank the members of my guidance committee; Dan Flores, Joseph Caruso, Michael Fillman, and Bruce Heinrich for their help and suggestions in the completion of this thesis. I would also like to especially thank Bruce Heinrich and Robert Mitchell for their help and for the patients they provided for this study. Dr. Grenith Zimmerman deserves special thanks for her help with the statistical analysis presented in this paper. Finally, I would like to thank American Orthodontics and Dave Schrock for their help and contribution of supplies for this study.

TABLE OF CONTENTS

INTRODUCTION

A number of treatment methods have been developed over the years in an attempt to correct various Class II malocclusions. Most of these treatment designs have met with success when they are used by the patient as directed by their orthodontist. Patient compliance has always been a major factor in the successful treatment of Class II. Because of a societal trend of reduced compliance, current developments are trying to focus on techniques which limit the effects of cooperation by the patient. An examination of the development of the various techniques will be helpful to understanding current ideas.

The use of extraoral force is probably one of the oldest techniques used in the correction of Class II. Some of the first mentions of extraoral force were by Kingsly in 1866 and Farrar in 1870. This appliance was more of a "head cap" design in comparison to current styles. These were mainly used for the treatment of protrusive incisors. It wasn't until 1921 when Case first mentioned extraoral forces used to move molars distally. Kloehn began the main trend in America toward extraoral forces to the maxilla shortly after 1947. He showed dramatic results with light forces and a neck strap. From there the appliance has gradually developed to the current manifestation of either a cervical, straight, or high pull headgear.[1]

There are some problems associated with the use of headgear. One of the biggest is poor acceptance by patients. With current attitudes of younger patients it has become more and more difficult to convince them to wear the appliance. This leads to frustration on the part of the patient, the parents, and the orthodontist. Another problem with headgear is the potential for extrusion of the molars if not adjusted properly. The force vectors in cervical headgear must be carefully monitored in order to direct them through the center of resistance of the tooth.[2] In brachyfacial types it may not be as critical due to the bite closing effects of their orofacial musculature. In dolichofacial types, extrusion of upper molars is more critical and easily leads to bite opening. As a response to this problem, high pull headgear is often used in these facial types. Unfortunately, this style is usually less acceptable than cervical headgear to the patient. Consequently patient compliance can be a definite problem with headgear therapy even if limited to night time wear.

Class II elastics are another method which has been used to correct Class II malocclusions. Again, this treatment depends on the compliance of the patient. If the elastics are worn as directed by the orthodontist, this can be a very effective approach to correction of molar position. This method has the advantage of being intraoral so patient acceptance is usually better than with headgear. However, the problem still remains that correction is in the hands of the patient.

Another factor which must be considered is the potential for extrusion of the lower molars and the upper incisors. This leads to rotation of the occlusal plane and can help to correct some of the Class II. A negative aspect of this can be a poor esthetic result in the anterior. It is also important that vertical growth of the ramus be equal to vertical extrusion of the lower molar in order to minimize downward rotation of the mandible.[3]

Functional appliances provide yet another treatment modality to correct Class II malocclusions. Functional appliances were developed primarily in Europe in the early 1900s with most variations tracing their roots back to Robin's monobloc appliance. Andresen developed the first widely accepted "activator" around 1920. Most functional appliances attempt to correct Class II by posturing the mandible forward. The desired result of this treatment is to stimulate or potentiate mandibular growth. This occurs mainly in a vertical direction through an adaptive response of the prechondroblastic and chondroblastic layer of cartilage particularly in the posterior condyle.[4,5] In addition, dental change is usually involved in the correction, with a Class II elastics and a headgear effect resulting in posterior movement of the maxillary dentition and anterior movement of the mandibular dentition.[6]

Functional appliances are another technique which is dependent on patient cooperation in order to obtain results. They are intraoral so they may be accepted more readily by the patient. The paradox is that even though they are called functional appliances, they do not really allow the patient to function while they are worn. Their size and bulkiness can be a problem for some patients and may lead to difficulty with speech. Because of this, patient compliance with full-time wear can be disappointing. Another limitation is the lack of ability to control the dentition in terms of rotations and aligning. Since this appliance is essentially only effective in growing, and preferably prepubescent patients, it is expected that two phases of treatment will be needed in most cases.

An appliance which some feel corrects the shortcomings of removable functional appliances is the Herbst™ appliance. Developed by Emil Herbst in 1905 and recently reintroduced by Pancherz, it acts in a manner similar to other posturing techniques but is fixed to eliminate patient compliance problems. It is also designed such that the patient is able to function with the appliance fixed in place.[7] Dr. Terry Dischinger has developed a variation which differs significantly from Pancherz' Herbst appliance. He refers to it as the Edgewise Bioprogressive Herbst appliance.[8] His variation consists of the rigid rod and tube mechanism common to Herbst appliances but allows control of the rest of the teeth during appliance therapy with auxillary wires. This is accomplished by full bracketing of the upper arch and bracketing of the lower incisors and molars with a lingual arch placed on the lower. The appliance also uses stainless steel crowns on the upper and lower first molars as well as on the lower first bicuspids. Better control of individual teeth is achieved by the placement of working tubes and slots on the stainless steel crowns which allows the use of archwires during appliance therapy.

The Herbst appliance is an improvement over removable functional appliances but may have problems due to the rigid nature of the rod and tube. This does not allow the patient to posture back to their original rest position, so they are not able to have any rest from the activation. The rigid nature of the Herbst can also be a contributor to poor oral hygiene. Since the patient is not able to move the appliance out of the way, they may tend to ignore the areas where the Herbst attaches.

An appliance which was developed a short time before Dischinger's Herbst variation is the Jasper Jumper™. Dr. James Jasper developed this appliance in an attempt to eliminate the undesirable actions which can result from the previously mentioned appliances as well as attempt to remove the need for patient compliance in correction of Class II malocclusion. The appliance works through a flexible push system which postures the mandible forward.[9] (See Figs. 1, 2)

The appliance is a large open-coil spring which is covered by a plastic sheath to keep it clean and minimize tissue irritation. For a headgear effect the lower arch is set in a rectangular stainless steel wire which is bent over distal to the molar tube. On the lower, the jumper is connected in the first bicuspid area where an offset bend is placed in the wire just distal to the cuspid bracket. On the upper, the jumper is connected through the headgear tube with a ball pin. The upper archwire is not bent over distal to the molar tube. This pits the upper molars against the entire lower arch and should deliver a headgear effect. (See Figs. 1, 2)

For an activator effect, the lower arch is set up the same as when a headgear effect is desired. The jumper is still placed in the first bicuspid region on the lower and runs to the headgear tube on the upper molars. In the upper arch the archwire is bent over distal to the molar tube, which pits the entire upper arch against the entire lower arch. This results in a functional effect.[10] (See Figs. 3, 4)

The Jasper Jumper has the advantages of being more flexible and allowing the patient to "function" while correcting Class II. The patient can also posture back and thus give a headgear effect while moving back

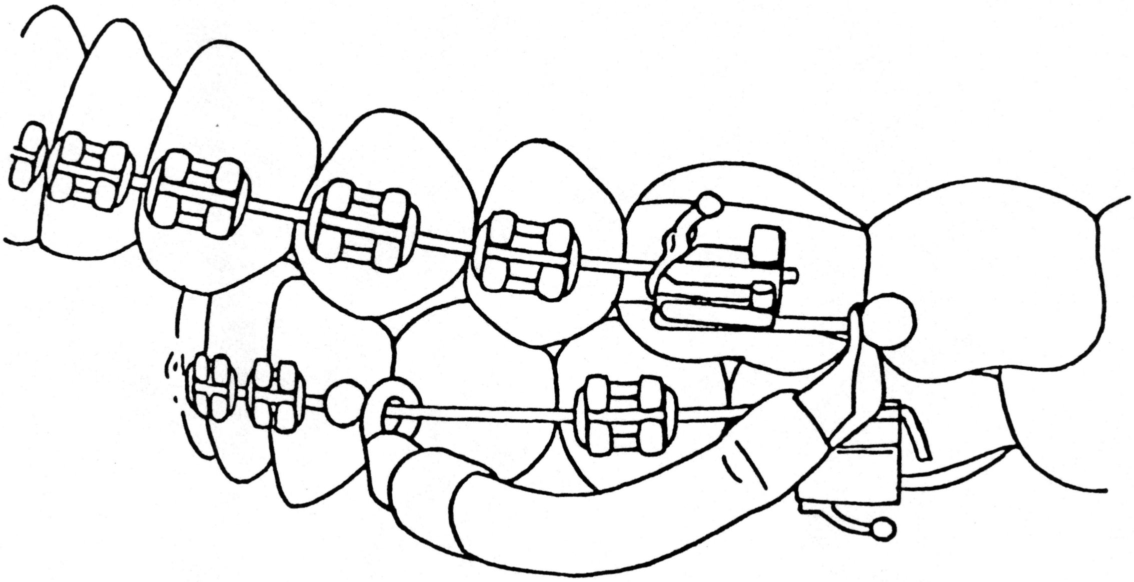

Fig. 1. Jasper Jumper activated for a headgear effect.

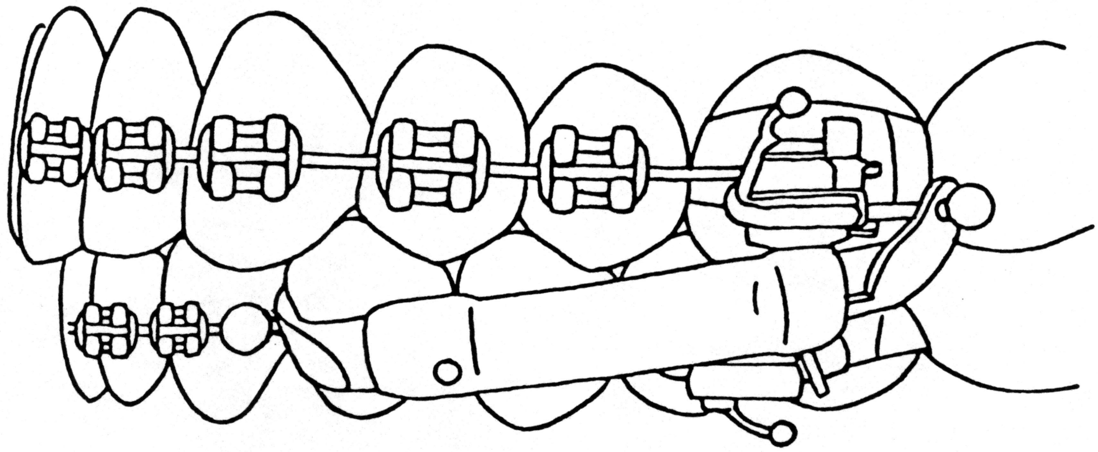

Fig. 2. Patient corrected to Class I with a headgear effect.

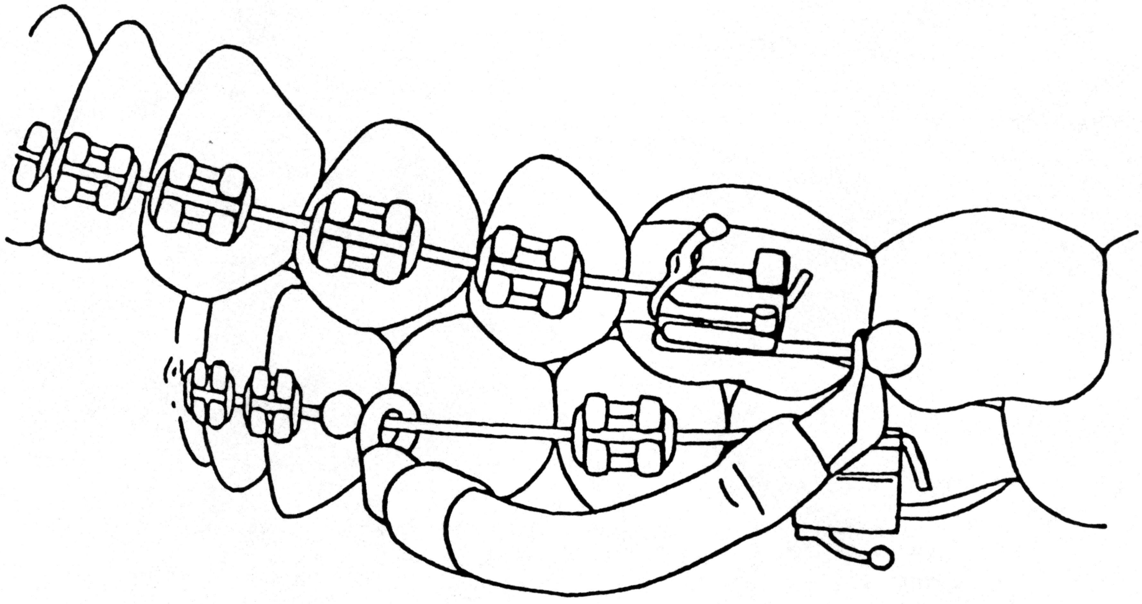

Fig. 3. Jasper Jumper activated for a functional effect.

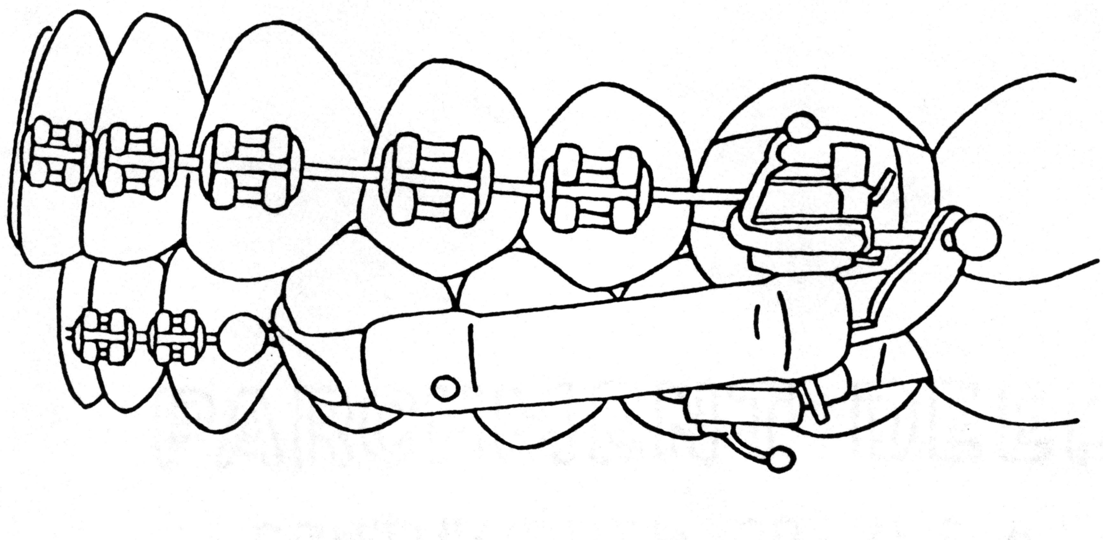

Fig. 4. Patient corrected to Class I with a functional effect.

to his or her more natural position. This appliance has the potential for better hygiene because the patient can flex it out of the way to brush more easily. However, any fixed appliance has the potential for oral hygiene problems.

The Jasper Jumper has some disadvantages. One which was just mentioned is the potential for oral hygiene problems due to this being a fixed appliance. Another problem which has been mentioned is breakage of the jumper by patients. Learning how to use the appliance and training staff how to work with it are also potential negatives. Two recent articles have been published which discuss some of the clinical variations and effects seen clinically with the Jasper Jumper.[11,12]

The appliance has been available since 1988 but at this point no research has been published on any of the results attained with jumper treatment. The purpose of this pilot study is to determine the dental and skeletal effects of Jasper Jumper treatment using cephalometric measurements.

METHODS AND MATERIALS

The records for ten patients were obtained from three locations, Loma Linda University Graduate Orthodontic clinic(2), Dr. Bruce Heinrich(3), and Dr. Robert Mitchell(5). The sample consisted of six male and four female patients with nine Caucasians and one Hispanic. The average age at the start of Jasper Jumper therapy was fourteen years eight months with an age range from twelve years zero months to sixteen years four months. Average treatment time was slightly over six months. The average age at the end of treatment was fourteen years two months. Patient facial types ranged from Mesofacial to Brachyfacial with no Dolichofacial types included in the sample.

Patients included in the study were all of growing age but race or sex were not factors considered for inclusion. All patients had end-on or greater Class II malocclusion with the average being 4.4 mm and a range of 3 mm to 7mm of Class II. This was measured on the occlusal plane of the tracings from the distal of the upper molar to the distal of the lower molar. Most patients included in the study were treatment planned to use Jasper Jumpers as the primary method for Class II correction and all patients were treated by nonextraction of permanent teeth. All patients were treated to Class I on both buccal segments. The jumper was removed on the first appointment where the patient was Class I or slightly overtreated from cuspid through molar. There was no waiting or holding period in Class I before the jumper was removed.

Three lateral cephs were evaluated for eight of the patients; initial pretreatment cephs, cephs taken just prior to jumper placement, and a post-jumper ceph taken two to four weeks after treatment was stopped.

In the remaining two patients only an initial and a post-treatment ceph were evaluated due to the relatively short time between beginning of treatment and start of Jasper Jumper therapy. The post treatment cephs were taken two to four weeks after jumper therapy was completed. This time period was arbitrarily chosen in an attempt to allow for immediate postural relapse to be expressed.

There were three x-ray machines used in this study. A Quint Sectograph 200 was used at Loma Linda University. Dr. Heinrich's patients were radiographed with a Quint Sectograph 100. Dr. Mitchell's patients were radiographed using a Belmont Cephalometric 098CM. Due to the fact that different x-ray machines were used at the three patient sources, a skull was radiographed at all three locations with a 50 mm metal ruler attached to the lateral surface. These three lateral cephs were then used to compare the skull and the ruler images and to calculate a magnification correction factor between the three x-ray machines. Based on these cephs a correction factor of .964 was applied to all linear measurements on patients from the one source which differed from the other two sources. This allowed all data to be evaluated with the same weight.

Initial, pre, and post jumper lateral cephs were hand traced by the author and compared using a Ricketts analysis and by superimposition at the cranial base. These measurements were recorded and statistically analyzed. Statistical analysis consisted of paired t-tests between the pre and post jumper measurements to locate significant changes.[13] In patients who did not have a pre jumper ceph, the measurements from the initial ceph were used for comparison.

Reliability tests were performed by the author by randomly selecting one initial lateral ceph and tracing it on three separate occasions. The values were recorded and analyzed statistically to calculate the coefficient of variation to determine the accuracy of the tracings.

The appliance was used in the same manner on all patients included in this study. Both arches were leveled and aligned and a 17^2 stainless steel(S.S.) wire was placed in the upper arch which was not bent over. The lower arch was set up with a 16x22 S.S. wire with bayonet bends placed just distal to the cuspid brackets. (See Fig. 8) The jumper was placed on the lower arch and the wire was bent over posterior to the molar tube. The jumper was then attached to the upper molar with a ball hook through the headgear tube. (See Fig. 7)

The correct size is selected by measuring from the mesial of the molar tube to the distal of the cuspid bracket or distal of the ball spacer. Twelve millimeters is added to the result when measuring to the ball or fifteen millimeters when measuring to the cuspid. (See Fig. 6) The result indicates which size jumper should be used. Dr. Jasper says the force levels are about eight ounces when the appliance is placed following these measurements.[14]

Activation of the appliance can be done at both points of attachment of the jumper. The ball hook can be bent shorter on the upper or another offset bend can be placed in the lower archwire in order to activate the jumper. The jumper is usually activated when the clinician feels that the appliance is straight or passive and not curved like the appliance exhibits at initial placement.

Fig. 5. Typical Class II patient before placement of Jasper Jumper.

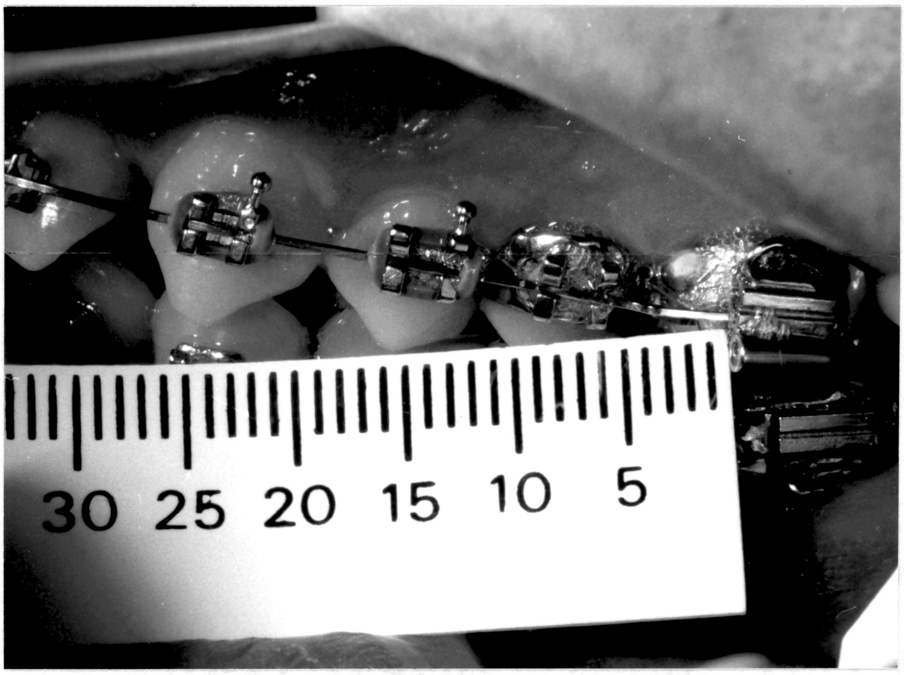

Fig. 6. Measurement to determine correct Jasper Jumper size.

Fig. 7. Jasper Jumper in place with patient corrected to Class I.

Fig. 8. Cuspid offset and removal of bicuspid bracket allowing appliance and patient to function.

RESULTS

The results of the paired t-tests between pre and post jumper cephs are provided in Table I, along with means and standard deviations for all measurements. Actual recorded values from all cephs for each patient are provided in Tables II to IV in the appendix. The following values are from the eight patients who had the initial, pre, and post jumper cephs since this group was considered to give the most accurate reflection of facial changes. The values for the the whole group of ten are provided in the appendix in Table V. Tracings and superimpositions for one representative patient are presented in Figs. 9-11 with the remainder of the patients presented in the appendix. (See Figs. 12-38)

The changes in the facial axis, which closed slightly from a mean 87.8 degrees to 88.3 degrees were not found to be significant at the .05 level. The maxillary depth measurements revealed a change which was significant as the mean value decreased approximately 0.87 degrees, from 90.87 to 90.0. The facial depth changes were significant and changes in the convexity showed a high significance value. The facial depth mean value increased 0.69 degrees from 86.5 to 87.19. The convexity mean decreased from 4.4 mm to 3.0 mm, a decrease of 1.4 mm on average.

The results of the t-tests on changes in the maxillary incisor position showed that there was not a significant change from pre to post jumper cephs. The maxillary incisor did come back from 8.5 mm to 7.3 mm, a mean reduction of 1.2 mm but was not significant. The maxillary incisor angle relative to Frankfort increased from 60.9 to 63.3 degrees. The gain of 2.4 degrees was not significant. Changes in the maxillary

Table I

Comparison between Pre and Post
Jasper Jumper cephalometric tracings n=8

Measurements	Pre J J		Post J J		p - value*
	Mean	Standard Deviation	Mean	Standard Deviation	
Facial Axis	87.8	2.84	88.4	2.97	0.14
Max. Depth	90.9	2.81	90.0	3.15	0.01
Facial Depth	86.5	2.45	87.2	2.59	0.004
Convexity	4.4	2.72	3.0	2.72	0.001
Max. 1 to APO	8.5	3.4	7.3	2.33	0.06
Md. 1 to APO	0.7	2.05	2.2	2.00	0.002
Max. 6 to PTV	17.2	3.78	16.3	3.93	0.03
Lo. lip to E-plane	0.5	3.43	-.1	2.66	0.28
Md. plane angle	23.8	3.32	23.3	3.28	0.28
Md. Arc	33.8	4.5	33.8	3.54	1.00
Lo. face height	44.9	1.9	45.1	1.66	0.45
Interincisal angle	114.9	8.76	114.9	7.72	1.00
Max 1 to Frankfort	60.9	5.08	63.3	4.91	0.13
Md 1 to Md plane	101.7	5.5	105.3	4.77	0.21
Frankfort to Occl.	-6.3	3.28	8.8	3.54	0.003
Frankfort to palate	4.1	3.66	3.7	3.43	0.40

* Results based on paired t-tests.

molar and mandibular incisor however, were significant. The maxillary molar was distalized from 17.2 mm to 16.3 mm, 0.9 mm on the average. The advancement of the mandibular incisor was 2.2 mm, moving from a pre jumper value of 0.7 mm to a post value of 2.9 mm.

The mandibular incisor angulation relative to the mandibular plane increased 3.5 degrees, from a mean pre jumper value of 101.7 to 105.3 degrees. The interincisal angle did not change from a mean of 114.9. The p values for both of these measurements were not significant. The lower lip movements were also not significant as the mean value only decreased 0.5 mm, starting at 0.45 mm and ending at -0.05 mm. The comparison of mandibular plane values showed only a small decrease of .44 mm, from a mean of 23.75 to 23.31 degrees. This change was not significant.

The mandibular arc showed no mean value variation from the pre value of 33.8 degrees and was not significant. The lower face height had only a very slight increase from 44.9 to 45.0 degrees, for a change of 0.1 degrees. This change in the lower face height was not significant. The comparison between Frankfort plane and occlusal plane showed an increase which was significant. The value went from -6.3 to -8.75 degrees, a mean increase of -2.4 degrees. The relationship between the palatal plane and Frankfort horizontal showed a slight decrease from 4.1 to 3.7 degrees, resulting in a mean change of .4 degrees. This change was not significant.

When the two patients without a pre jumper ceph were included in the statistical analysis, only two measurements changed in terms of statistical significance. The change in the facial axis still showed an increase as it closed, but the change became significant. The measurement of maxillary molar to pterygoid vertical changed to a value which was not significant.

Patient # 5
Female, Caucasian
Age 12-5
Pre-J J

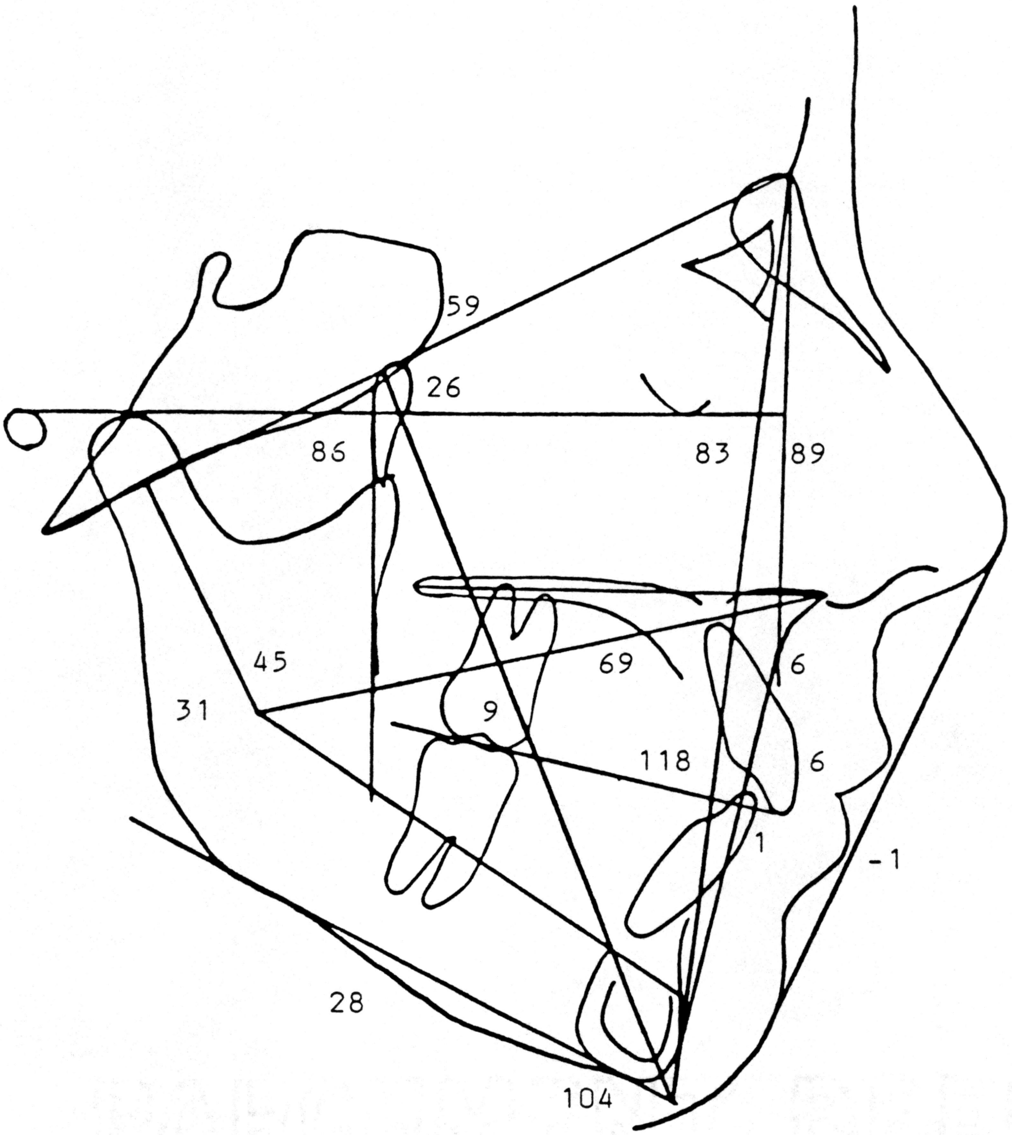

Figure 9

Patient # 5
Female, Caucasian
Age 12-11
Post-J J

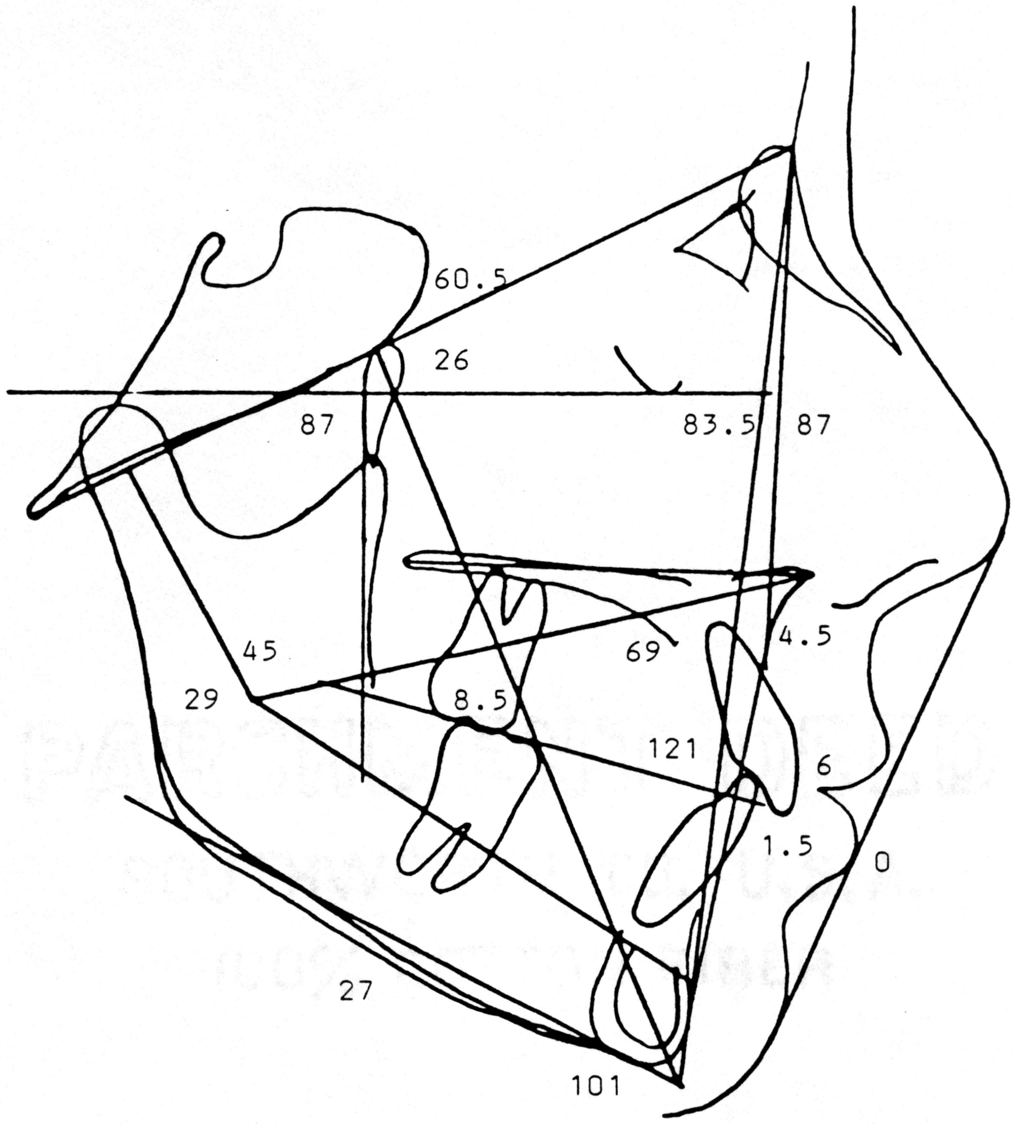

Figure 10

Patient # 5
Superimpositions
Pre ——— Post - - - - -

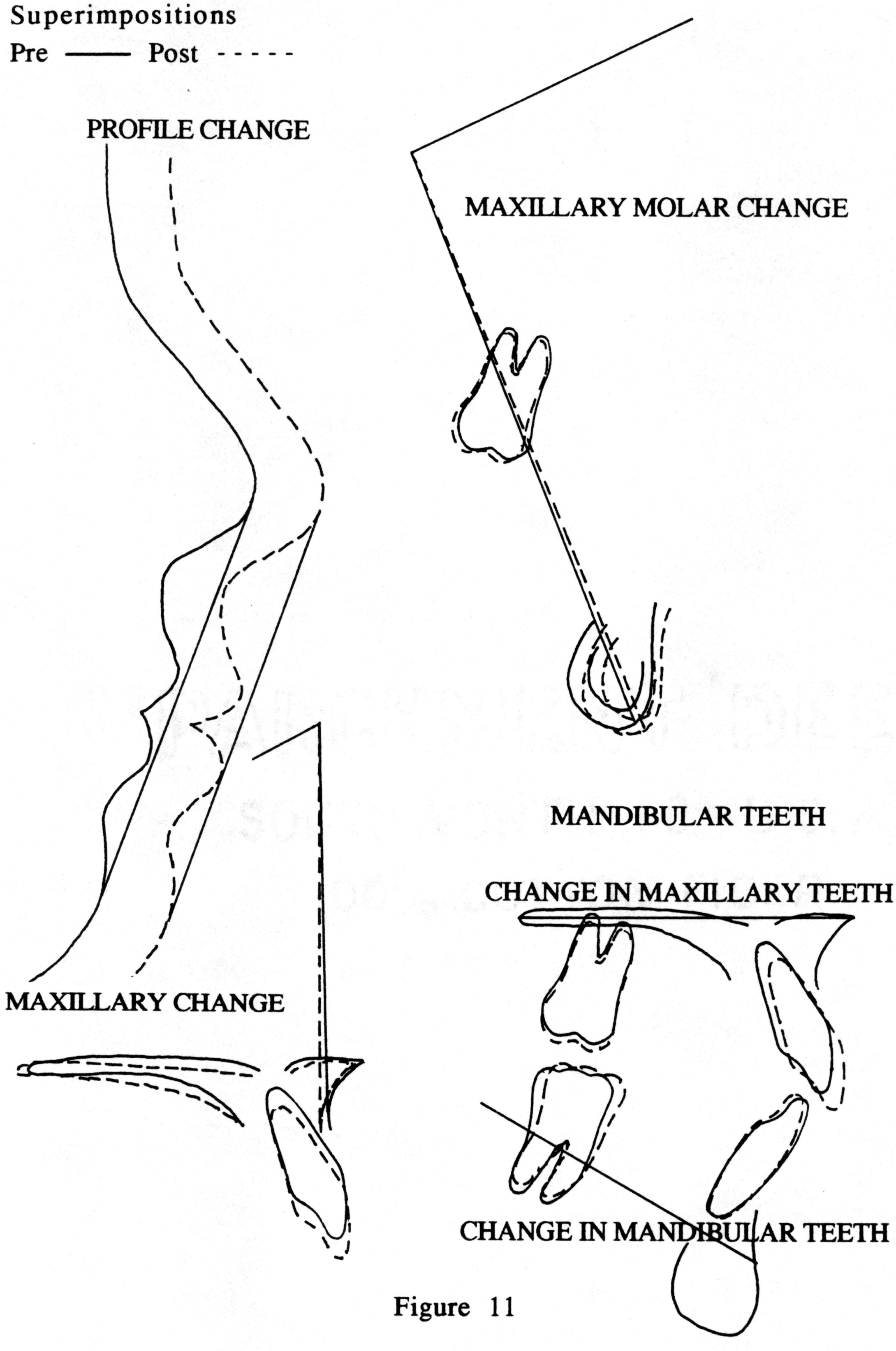

Figure 11

The results of the reliability tests are given in Table VI in the appendix. In general, values for coefficient of variation(C.V.) are not considered significant if they are below five percent. In this study only three of the seventeen values were above five percent. The C.V. for the mandibular incisor was -43.3. The value for the lower lip to esthetic plane was -13.32. The final measurement with a C.V. above five percent was the mandibular arc measurement. The C.V. for this was 5.97.

DISCUSSION

The problem of patient compliance has become a significant dilemma in today's orthodontic practice. Because of this, it is important to minimize the effects which poor compliance can have on the success of the orthodontist's treatment goals. An appliance which may help to solve some of the problem is the Jasper Jumper. It was the purpose of this pilot study to investigate the effects of Jasper Jumper therapy through a cephalometric evaluation of patients treated to Class I with this appliance and evaluate if additional studies are indicated.

The statistical analysis of the tracings revealed some important findings. One interesting result was the fact that the facial axis closed during treatment. Even though one would not expect the facial axis to open much given the patients' meso to brachyfacial patterns, it is still useful to know that this appliance does not seem to counteract this tendency. The results also show that the lower face height was not affected significantly. This is positive because it indicates that there is probably little or no extrusive effect as the appliance corrects the Class II. Based on these two measurements it can be seen that the bite did not open and the intrusive forces the appliance may generate are partially responsible.

Some other interesting results of the treatment were seen in measurement changes in the maxillary depth, facial depth and convexity. The maxillary depth decreased almost one degree. This change could be reflecting a minor orthopedic effect since the maxillary depth is normally constant during growth. The facial depth angle increased during treatment and the change of almost 0.7 degrees was statistically significant. The normal change in this measurement would be about 0.33 degrees per year. Since treatment time was approximately six months on average, the change in facial depth is about four times more than normal. It seems possible that this change is a functional effect of the appliance.

The convexity decreased during treatment by an average of close to 1.5 mm, a statistically significant amount. This result was due to the combination of facial depth increase through mandibular growth and the reduction of maxillary depth. Remodeling of A-point may also have affected the change in convexity as the incisors retracted and detorqued some during correction of the Class II even though these changes were not statistically significant. The alteration in these three measurements shows some positive trends as the appliance corrects the malocclusion.

Dental changes provided some interesting information. The lower incisor advanced an average of 2.2 mm with tipping, a statistically significant change. Even though this was a significant change, in the author's opinion it is not an excessive amount considering the average patient was slightly more than four millimeters Class II at the start of jumper therapy. An interesting factor was that the incisor did not flare significantly as it advanced. The angle between mandibular plane and lower incisor only increased 3.5 degrees. From these results it can be seen that the Jasper Jumper does advance the lower incisor with minor flaring.

Along with the minor change in angulation of the lower incisor it was seen that the interincisal angle did not change significantly. This shows that flaring of the anteriors was kept to a minimum for the patients in this study. As the Class II was corrected, the upper incisor moved back on the average slightly more than 1 mm. The upper incisor also detorqued as it came back so the actual retraction of the incisors was minor.

The changes in the position of the upper molar revealed some useful information. The upper molar moved back almost 0.9 mm, a statistically significant change. The molar would normally come forward about 0.5 mm during the treatment time of six months, so the molar is about 1.5 mm more distal than in a normally growing patient. This shows good distal movement, but in clinical observation substantial space opened between the molar and second bicuspid. Because of this, it appeared the upper molar was moving even more distally than these measurements reveal.

An explanation for this might be that a significant portion of the space opened comes from distal rotation of the molar. This distal rotation was a definite factor in correcting the Class II. However, it is likely that not all of this effect can be seen from a lateral ceph perspective. It is surprising that more of a headgear effect was not seen since the appliance was set up to deliver a headgear effect. Instead, the results show a combination of headgear and functional effects which was not expected.

The changes in the palatal and occlusal planes indicated a couple of interesting trends. Relative to Frankfort plane, the palatal plane tipped down anteriorly. This would indicate a possible headgear or orthopedic effect as the Class II was corrected. The occlusal plane was seen to elevate in the posterior. This could be due to the intrusive effects of the appliance. This effect would seem to be different than the changes which can occur with Class II elastics. Although both techniques may elevate the occlusal plane in the posterior, the jumper appears to do this through intrusion of the upper molars, while elastics would more likely extrude the lower molars. The end result can be the same, but the intrusive effect should have less potential for bite opening than the extrusive effect of the elastics.

During the evaluation of the pre and post jumper tracings it became apparent that there was an effect somewhat similar to that produced by Class II elastics. However, there were some important differences. All the patients were corrected to Class I, but unlike elastics the correction did not come primarily from advancement of the lower arch. Superimposing on Corpus axis at Pm showed that most patients had only minor advancement of the lower arch. (See Fig. 11 and the superimpositions in the appendix) When the tracings were superimposed at occlusal and facial planes, it was seen that the upper arch was moving back more than the lower arch was advancing. The ratio varied from patient to patient but was usually at least 50:50, with some patients showing even more upper arch distalization.

This result is most likely due to the efficiency of the appliance as it was used in this study. The lower arch is only pitted against the upper molars initially, rather than the entire buccal segment. It seems reasonable that this would tax the lower anchorage less than Class II elastics which include the entire buccal segment. By concentrating the distalizing force on two teeth rather than eight upper teeth, the upper molars are more effectively distalized. Once the upper molars are in

Class I, the rest of the buccal segment can be sequentially brought back into Class I as well with less taxing of the lower arch than with Class II elastics.

This appliance also has other advantages when compared to elastics. One would obviously be the constant activation and lack of need for patient compliance in terms of activating the appliance. Patients' acceptance of the jumper was good and breakage was minimal. It is important to inform patients that they must be careful not to bite or chew on the appliance, but this is usually not a problem. It is also beneficial that as the jumper corrects the Class II it distal rotates the molars and intrudes. This is in contrast to elastics which can mesially rotate the lower molars as well as extrude the molars and cuspids.

It should be mentioned that one patient did experience some relapse during the period between appliance removal and the post jumper ceph appointment. This patient had the greatest amount of Class II (7 mm) and he was completely corrected to Class I before the appliance was removed. During the month before his ceph was taken, he slipped back to about 2 mm Class II. This would indicate that there might have been some posturing in this patient. This might indicate that patients with correction of larger amounts of Class II need more careful management in transition from jumper treatment to finishing phases. Holding or overtreating the patient in Class I would also be beneficial.

The results of the reliability tests showed that there was good accuracy in the tracings. Only three of the seventeen measurements had a Coefficient of Variation (C.V.) above the five percent level of significance. The C.V. for the mandibular incisor was -43.3. This is high due to the fact that this measurement has a very small mean and any slight variation will yield a high C.V. The value for the lower lip to esthetic plane was -13.32. Again, this is due to a small mean which is easily affected by any variation. The other measurement with a C.V. above five percent was the mandibular arc, with a C.V. of 5.97. This significant value is due to the variability in selection of Xi point.

CONCLUSIONS

The results of this pilot study should be considered preliminary in nature due to the sample size. They do, however, help to show some of the trends and points of interest for future study. Some of the conclusions which can be drawn from this study are:

1) The facial axis does not open and the lower face height does not increase significantly in the facial types included in this study.
2) Overall the appliance appears to deliver an intrusive effect to the upper molars.
3) Superimposition of tracings revealed efficient orthodontic movement of the maxillary molar with some advancement and minor flaring of the mandibular incisor.
4) There appears to be both orthopedic and functional effects as demonstrated by the changes in convexity with tipping of the palatal plane and increase in the facial depth beyond normal growth increases.
5) Reliability tests showed good accuracy for tracings in this study.

In addition to these conclusions it is important to mention some suggestions which would be helpful in future studies:

1) More control over the records with all patients coming from one source and radiographed at one source.
2) All patients must have initial, pre and post jumper cephs.
3) A larger sample size would provide a more accurate picture of the results from treatment with this appliance.

4) Patients should be matched for sex and age in order to draw more accurate conclusions as to how these factors affect the results of jumper treatment.
5) Radiographs should be taken with enhancement screens in order to allow better visualization of the condylar area to determine effects on mandibular length increase.
6) Inclusion of non-growing patients would provide information on how the appliance works without growth potential.
7) A long-term follow-up period to determine the long-term stability of the effects of treatment.

APPENDIX

Table II

Recorded cephalometric measurements for patients studied

Measurements	Patient #1			Patient #2			Patient #3			Patient #4		
	T 1	Pre J J	Post J J	T 1	Pre J J	Post J J	T 1	Pre J J	Post J J	T 1	Pre J J	Post J J
Facial Axis	90.5	90	89.5	89.5	88.5	90	86	86	85.5	83	83	84
Cranial Deflect.	27	27	27	27	27	27	32	32	32	28.5	28.5	28.5
Ant. Cranial Base	67.5	68	69	62.5	64.5	65	60	62.5	62.5	57.5	60	60
Max. Depth	88	88	87.5	92	90.5	90	90	90	89.5	91	92	92
Facial Depth	85	85	85	86.5	87	88	87	87.5	88	84	84	85
Convexity	3	3	2	5.5	4	2	1.5	2	1.5	7	8	7.5
Max. 1 to APO	17.5	13	11	9	10	9	10	12.5	9.5	10	8	7
Md. 1 to APO	.5	2	5.5	.5	1.5	4	-1.5	4	5.5	-.5	-1	0
Max. 6 to PTV	19	20.5	19	17	17	17	12	15.5	13	15.5	18.5	17
Lo. lip to E-plane	5	4	1.5	1.5	1	0	-1	3.5	2	-2	-2	-2
Md. plane angle	26	25	26	25	25	23	21	19	19	25.5	25	24
Md. Arc	31	35	35	31.5	33	33	32.5	37.5	37	28	27.5	30.5
Lo. face height	47	47	47.5	41	42	42.5	48	46	46	47	47	46.5
Interincisal angle	104	109	111	126	115	105	129	106	107	120	104	117
Max 1 to Frankfort	45	58	65	68	58	58	55	52	57.5	65	61	66
Md 1 to Md plane	96	105	107	98	99	110	86	108	113	100	102	105
Frankfort to Occl.	-7	-4	-8	-8	-6	-6	-3	-2	-5	-14	-9	-12
Frankfort to palate	7	7.5	7	2	2	2.5	7.5	5.5	4	3	2.5	1

Table III

Recorded cephalometric measurements for patients studied

Measurements	Patient #5			Patient #6			Patient #7			Patient #8		
	T 1	Pre JJ	Post JJ	T 1	Pre JJ	Post JJ	T 1	Pre JJ	Post JJ	T 1	Pre JJ	Post JJ
Facial Axis	87.5	86	87	90.5	91.5	91.5	90.5	90.5	92.5	88	87	87
Cranial Deflect.	26	26	26	28.5	28.5	28.5	29.5	29.5	29.5	28	28	28
Ant. Cranial Base	58	59	60.5	58.8	60.8	60.8	65.6	66.5	66.8	60.8	61.7	61.7
Max. Depth	89	89	87	94	93.5	93	96	96	95	88	88	86
Facial Depth	84	83	83.5	90	90.5	91	88.5	88.5	90	87	86.5	87
Convexity	5	6	4.5	3.9	2.9	1.9	7.7	8.3	5.8	1	1	-1
Max. 1 to APO	6	6	6	3.9	4.8	5.8	7.2	9.6	6.3	6.8	3.9	3.9
Md. 1 to APO	1	1	1.5	-.5	1.5	2.9	.5	-1	1.5	-1.5	-2.4	1.9
Max. 6 to PTV	10	9	8.5	15.9	17.4	16.4	20.3	21.2	21.2	17.4	18.3	18.3
Lo. lip to E-plane	0	-1	0	-1	-1.9	-1	2.4	4.8	3.9	-4.3	-4.8	-4.8
Md. plane angle	27.5	28	27	23	22.5	23.5	19	19	18	26	26.5	26
Md. Arc	27.5	31	29	31	34	34	38	42	40	30	30.5	32
Lo. face height	45	45	45	43	43.5	44	44	43	43.5	43.5	46	45.5
Interincisal angle	126	118	121	134	114	114	126	123	129	122	130	115
Max 1 to Frankfort	74	69	69	75	62	57	70	62	66	63	65	67.5
Md 1 to Md plane	101	104	101	98	105	100	104	101	100	95	90	106
Frankfort to Occl.	-14	-12.5	-15	-9	-6	-6	-7	-4	-7	-8	-7	-11
Frankfort to palate	.5	-1	-1	7	8	6	9	8	9	0	0	1

Table IV

Recorded cephalometric measurements for patients studied

Measurements	Patient #9			Patient #10		
	T 1	Pre J J	Post J J	T 1	Pre J J	Post J J
Facial Axis	89	-	90.5	91.5	-	92
Cranial Deflect.	26	-	26	28	-	28
Ant. Cranial Base	62.2	-	63.6	60.8	-	61.7
Max. Depth	89.5	-	88	95	-	95
Facial Depth	84.5	-	86	89	-	90
Convexity	5.8	-	1.9	6.8	-	5.8
Max. 1 to APO	7.7	-	9.2	9.2	-	9.2
Md. 1 to APO	1.9	-	3.4	5.3	-	5.8
Max. 6 to PTV	12.5	-	12.5	22.2	-	23.1
Lo. lip to E-plane	-2.9	-	-.5	2.9	-	1.9
Md. plane angle	17	-	17	25	-	25
Md. Arc	41	-	42.5	25.5	-	26
Lo. face height	41	-	41	43.5	-	43
Interincisal angle	118	-	118	115	-	113
Max 1 to Frankfort	68	-	65	64	-	57.5
Md 1 to Md plane	113	-	110	105	-	100
Frankfort to Occl.	-7	-	-9	-5	-	-5
Frankfort to palate	2.5		1.5	6		4.5

Table V

Comparison between Pre and Post Jasper Jumper cephalometric tracings for all patients n=10

Measurements	Pre J J		Post J J		p - value*
	Mean	Standard Deviation	Mean	Standard Deviation	
Facial Axis	88.3	2.77	88.9	2.91	0.045
Max. Depth	91.2	2.86	90.3	3.29	0.006
Facial Depth	86.6	2.41	87.4	2.49	0.001
Convexity	4.8	2.53	3.2	2.59	0.001
Max. 1 to APO	8.5	3.02	7.7	2.20	0.16
Md. 1 to APO	1.3	2.32	3.2	1.99	0.001
Max. 6 to PTV	17.2	4.04	16.6	4.32	0.09
Lo. lip to E-plane	0.4	3.32	0.1	2.43	0.58
Md. plane angle	23.2	3.67	22.9	3.59	0.27
Md. Arc	33.7	5.4	33.9	4.99	0.69
Lo. face height	44.4	2.11	44.5	2.01	0.73
Interincisal angle	115.2	7.79	115.0	6.91	0.94
Max 1 to Frankfort	61.9	5.07	62.9	4.76	0.53
Md 1 to Md plane	103.2	6.03	105.2	4.83	0.39
Frankfort to Occl.	-6.3	2.94	-8.4	3.34	0.002
Frankfort to palate	4.1	3.33	3.6	3.12	0.15

* Results based on paired t-tests.

Table VI

Recorded values of Reliability tests
for cephalometric tracings n=3

Measurements	Mean	Standard Deviation	Coeff. of Variation
Facial Axis	82.83	.2887	0.35
Max. Depth	90.3	.5774	0.64
Facial Depth	83.3	.5774	0.69
Convexity	7.0	0.0	0.00
Max. 1 to APO	10.17	.2887	2.84
Md. 1 to APO	-.67	.2887	-43.3
Max. 6 to PTV	15.0	.5000	3.33
Lo. lip to E-plane	-2.17	.2887	-13.32
Md. plane angle	26.0	.5000	1.92
Md. Arc	29.0	1.732	5.97
Lo. face height	46.67	.5774	1.24
Interincisal angle	119.0	1.000	0.84
Max 1 to Frankfort	64.8	.2887	0.45
Md 1 to Md plane	100.7	.5774	0.57
Frankfort to Occl.	-14.7	.5774	-3.94
Frankfort to palate	3.0	0.0	0.00

Patient # 1
Male, Caucasian
Age 12-11
Pre-JJ

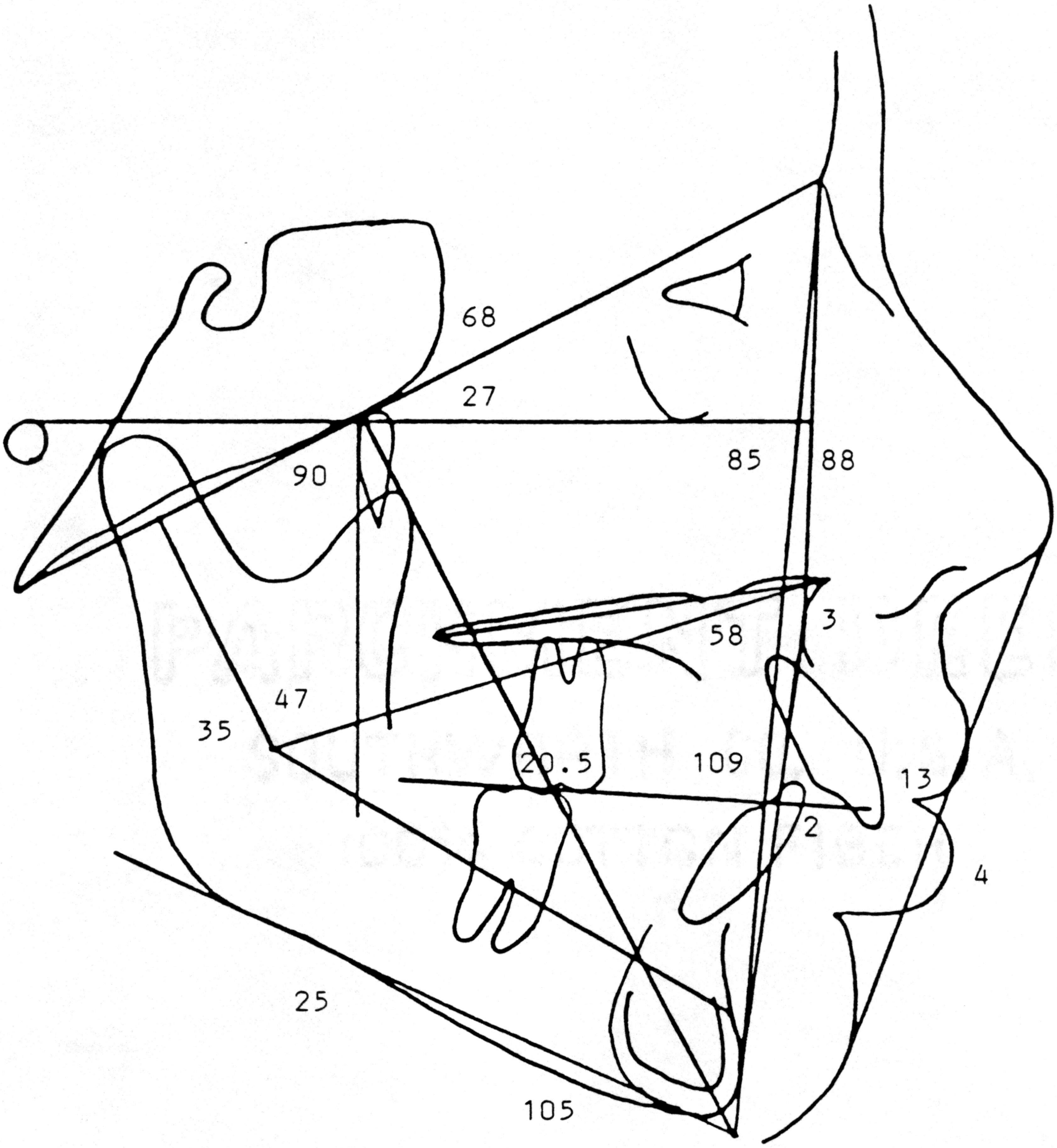

Figure 12

Patient # 1
Male, Caucasian
Age 13-6
Post-JJ

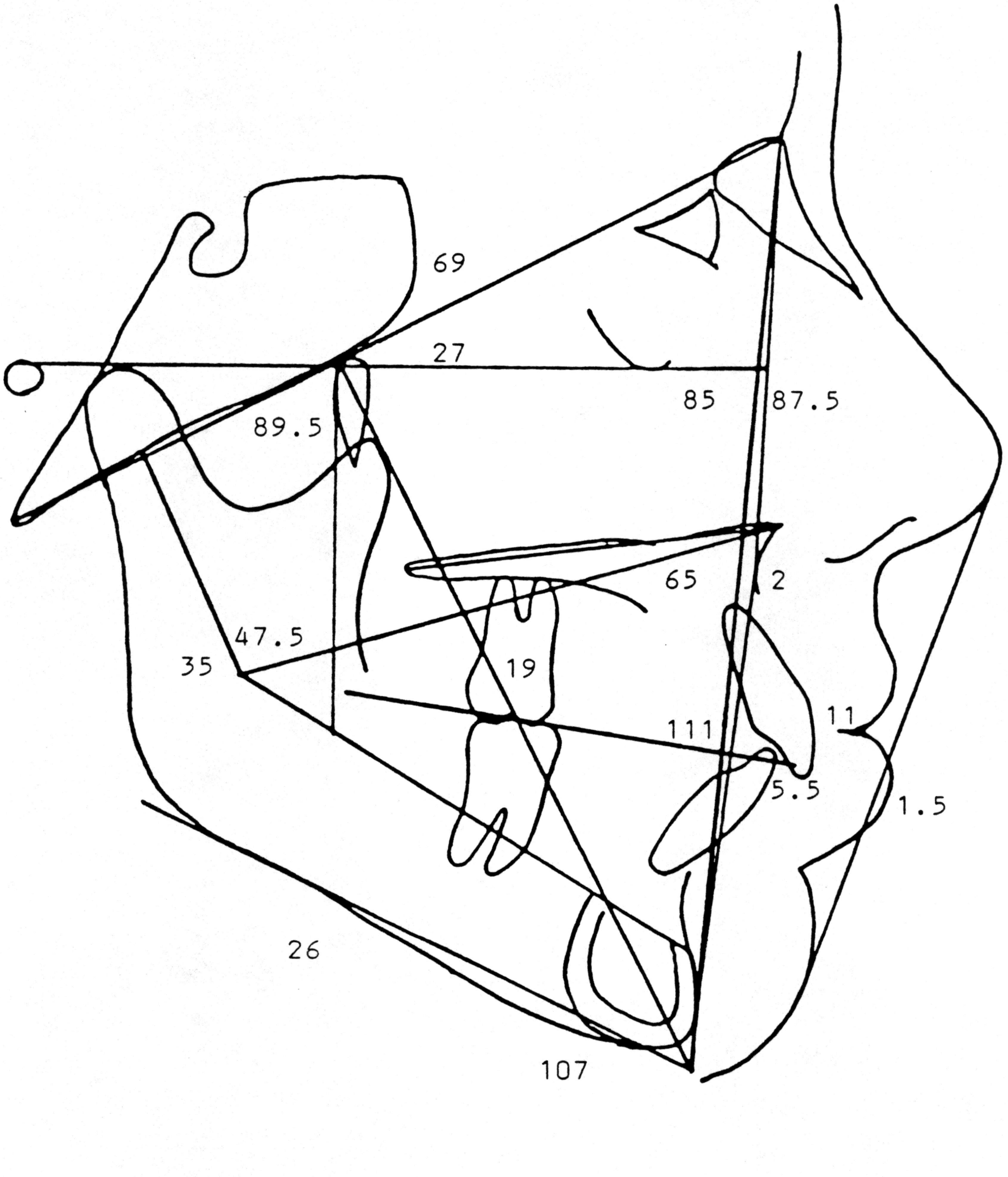

Figure 13

Patient # 1
Superimpositions
Pre —— Post - - - - -

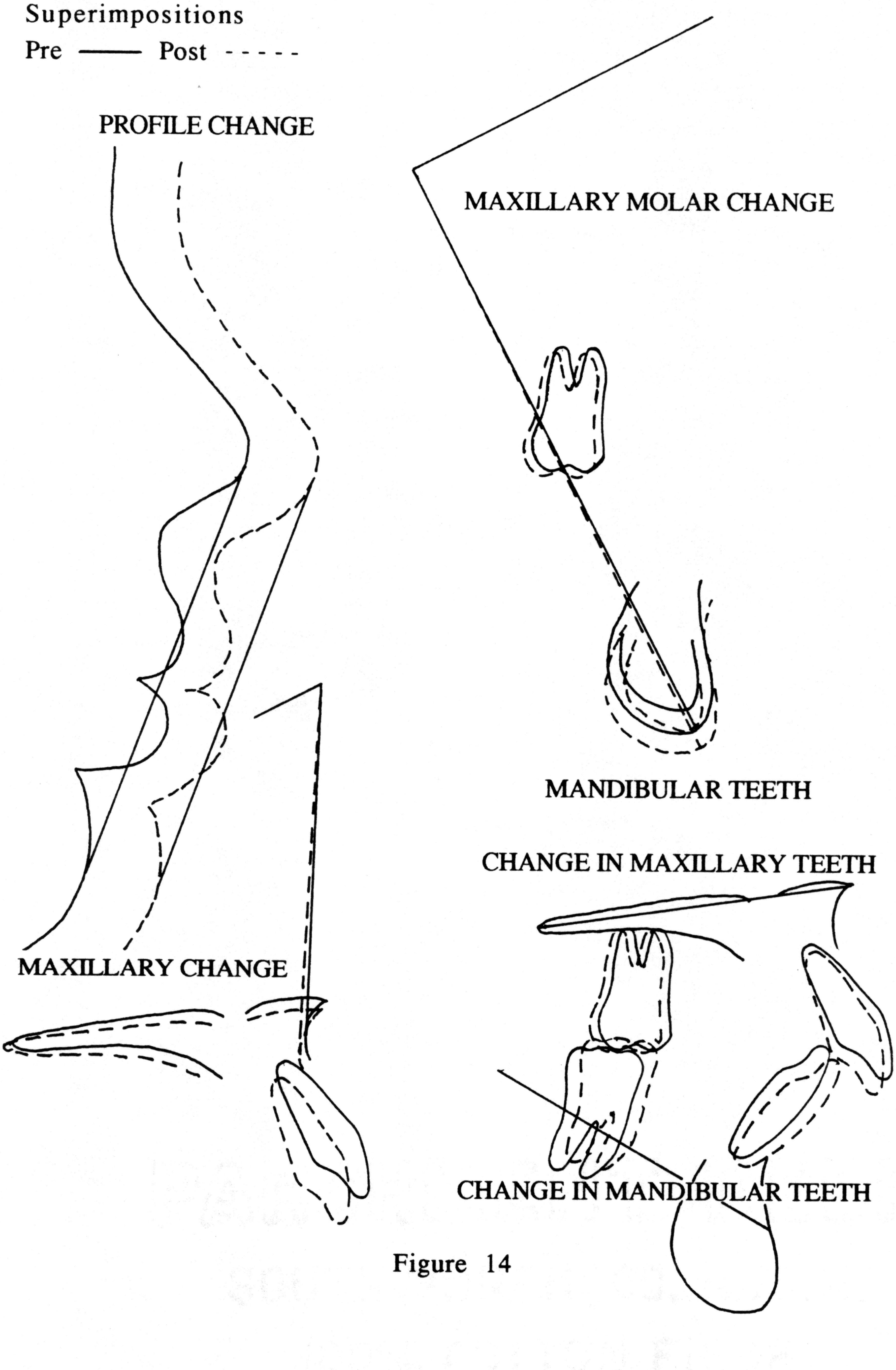

Figure 14

Patient # 2
Male, Caucasian
Age 15-10
Pre-JJ

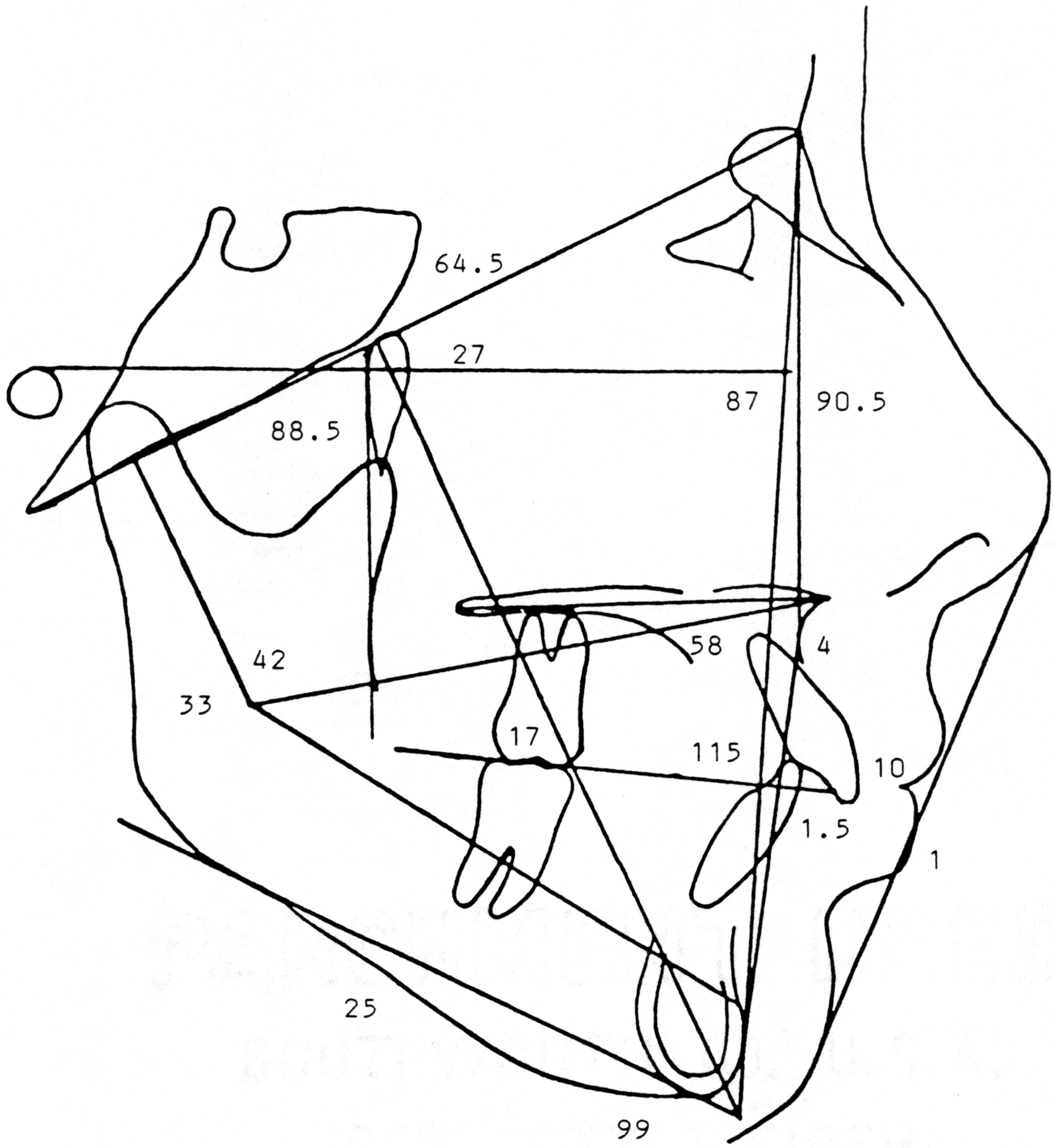

Figure 15

Patient # 2
Male, Caucasian
Age 16-5
Post-JJ

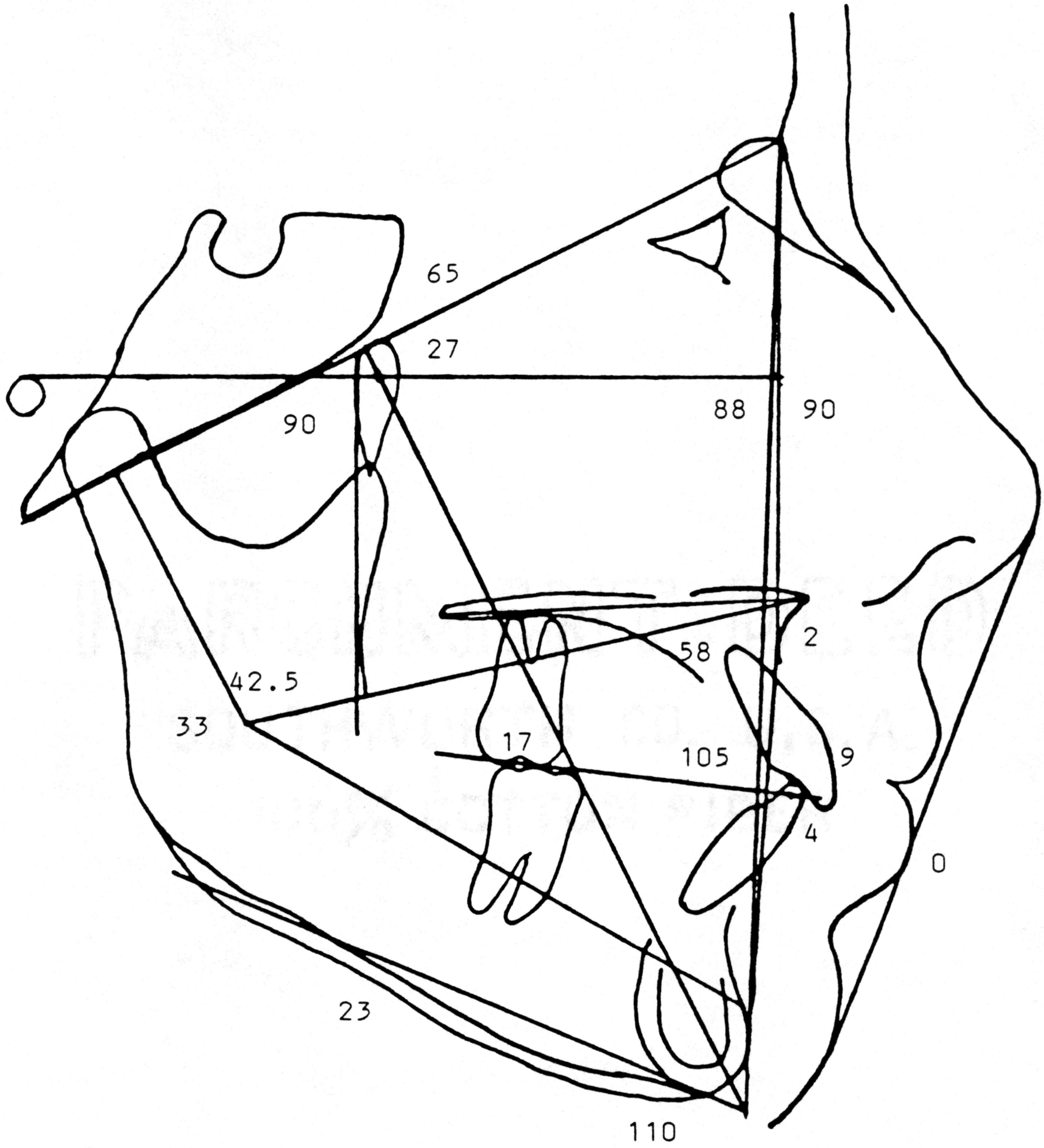

Figure 16

Patient # 2
Superimpositions
Pre ——— Post - - - - -

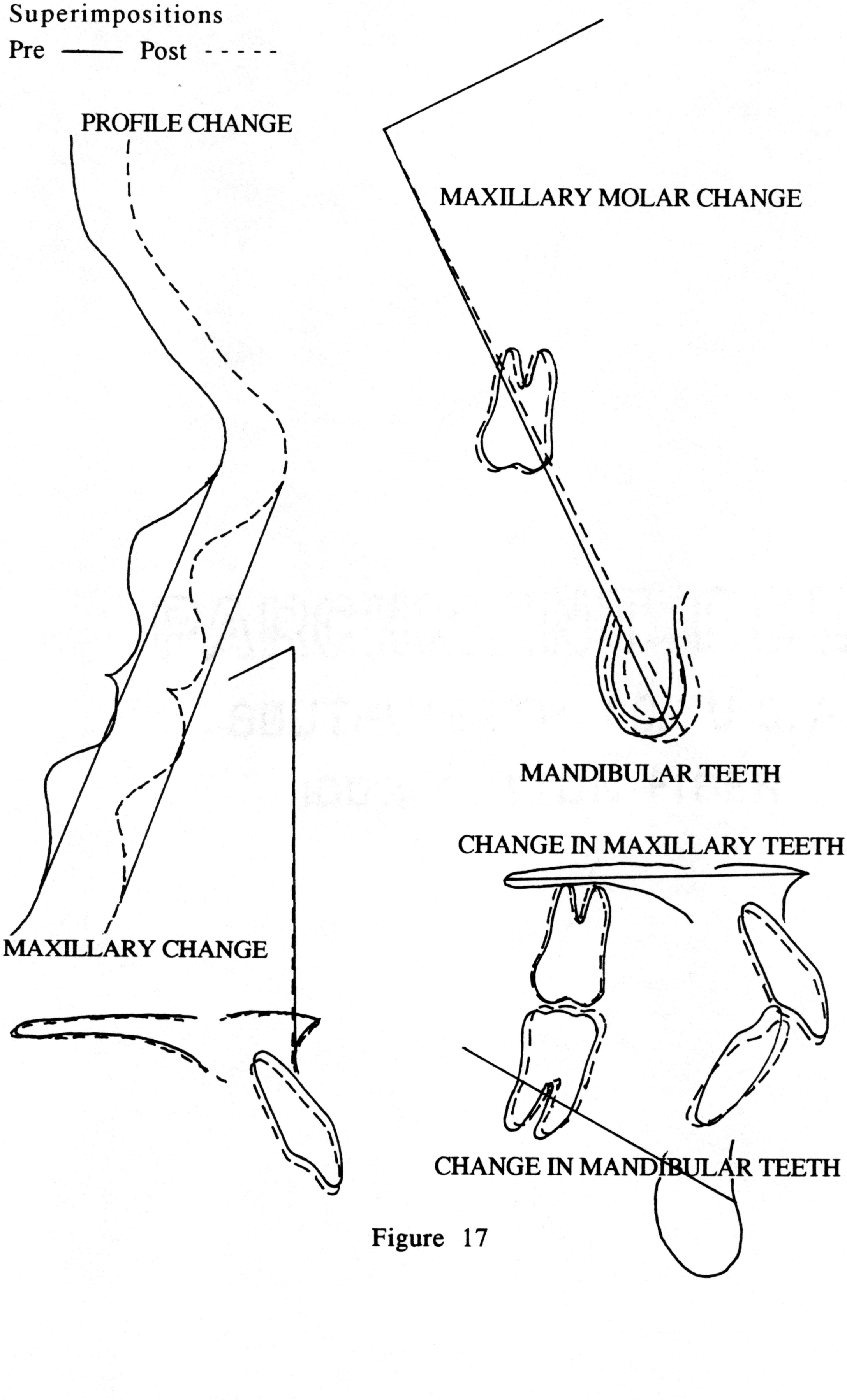

Figure 17

Patient # 3
Male, Caucasian
Age 15-4
Pre-JJ

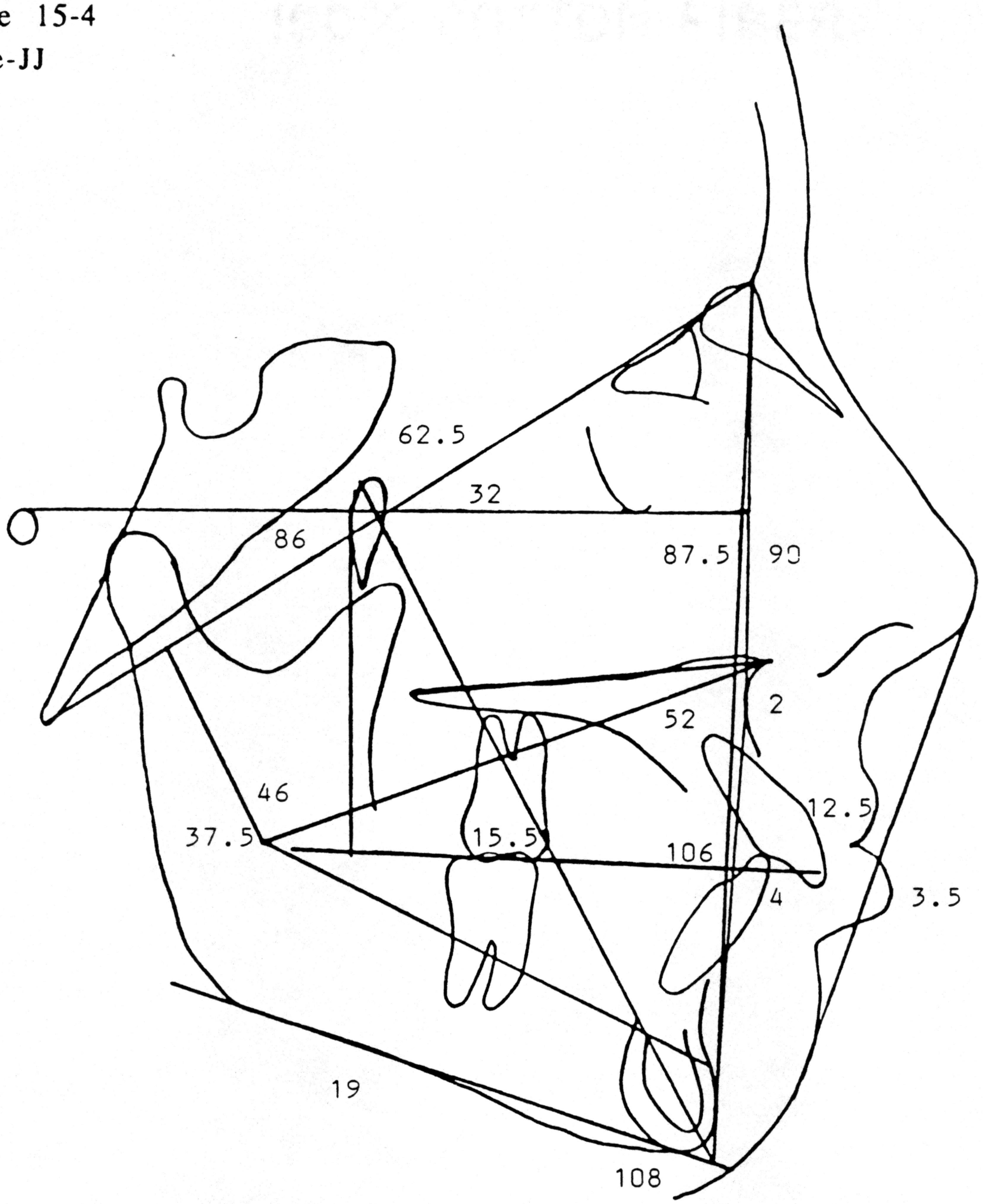

Figure 18

Patient # 3
Male, Caucasian
Age 15-11
Post-JJ

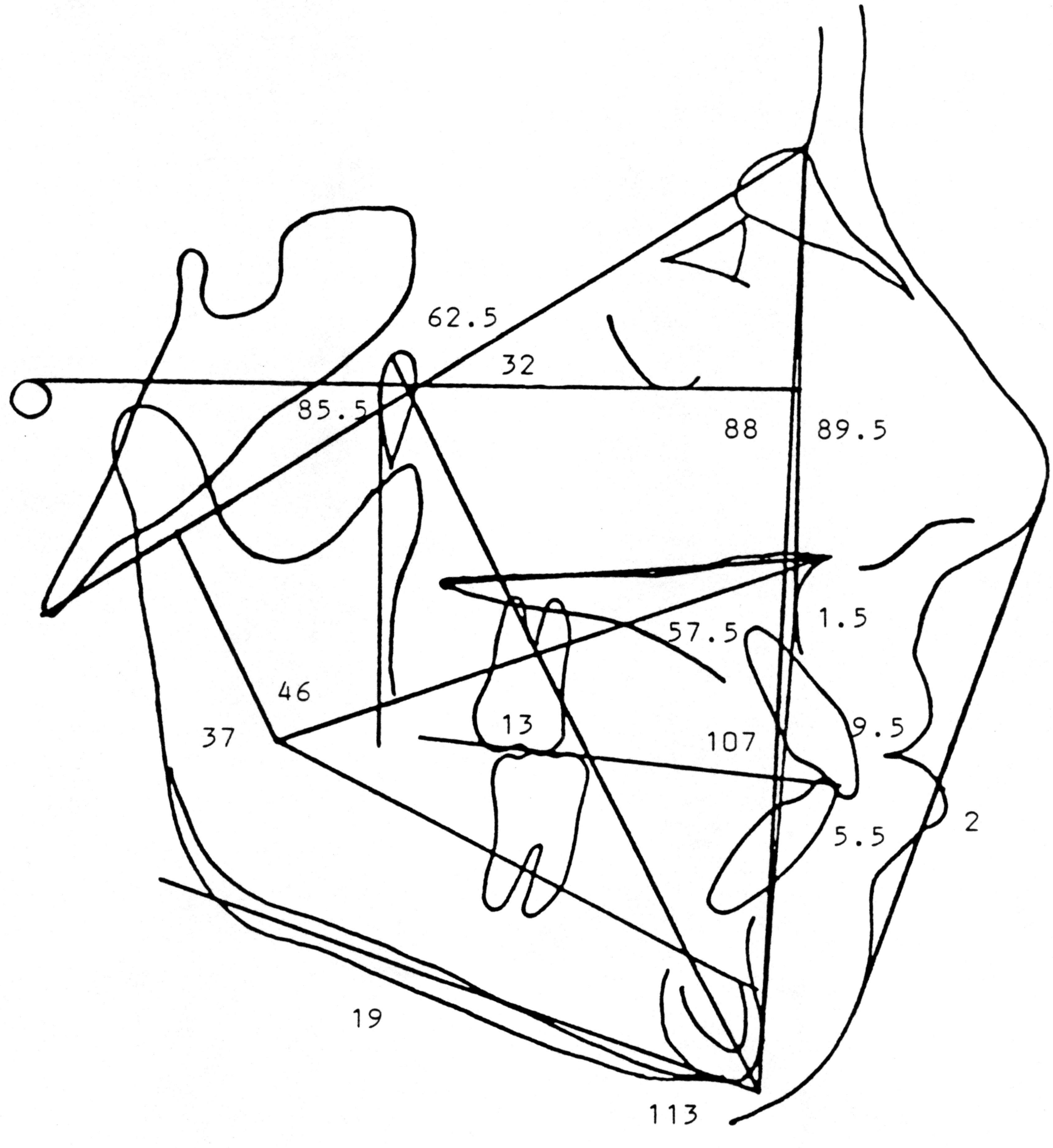

Figure 19

Patient # 3

Superimpositions

Pre —— Post - - - - -

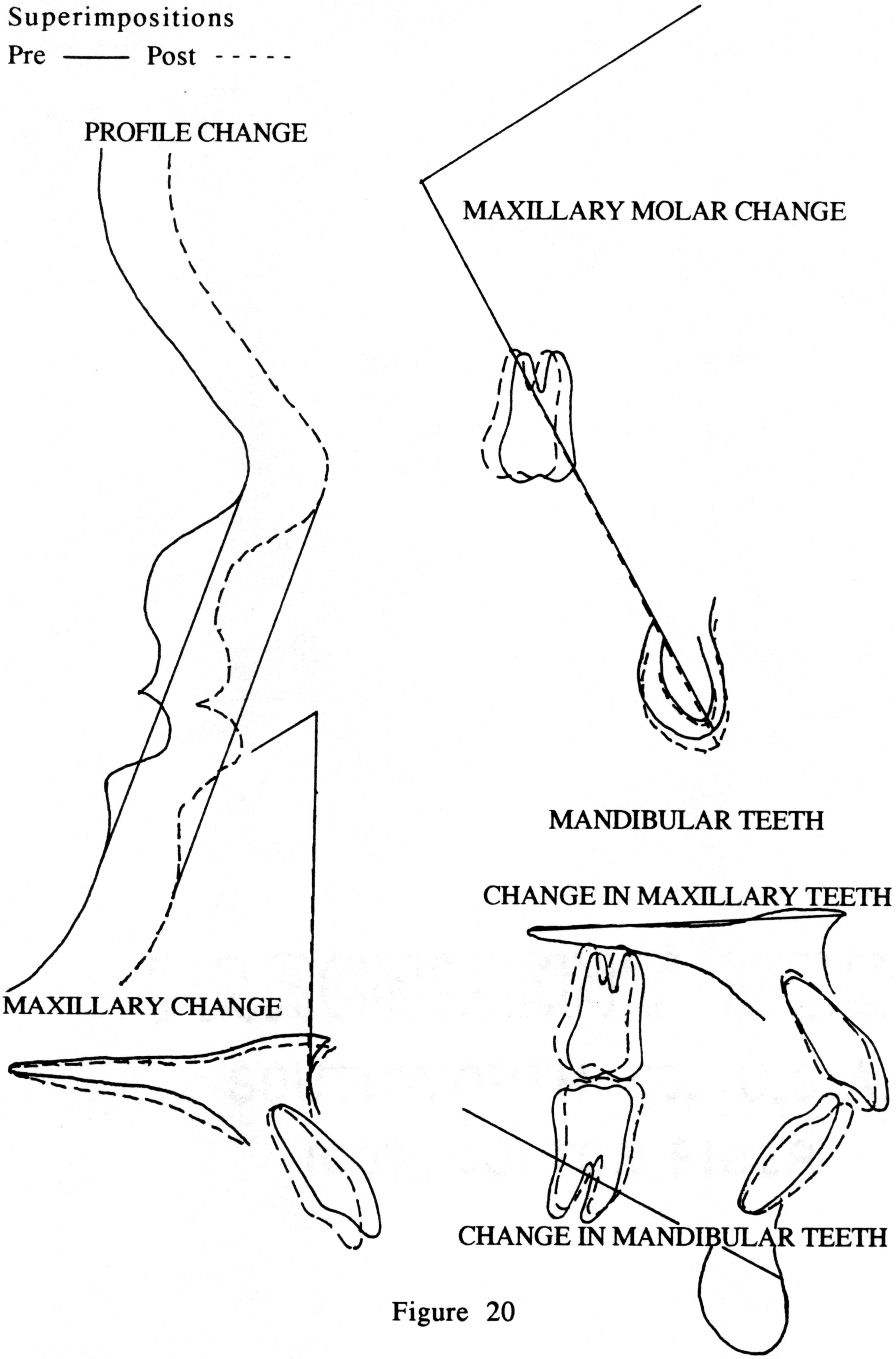

Figure 20

Patient # 4
Female, Caucasian
Age 12-0
Pre-JJ

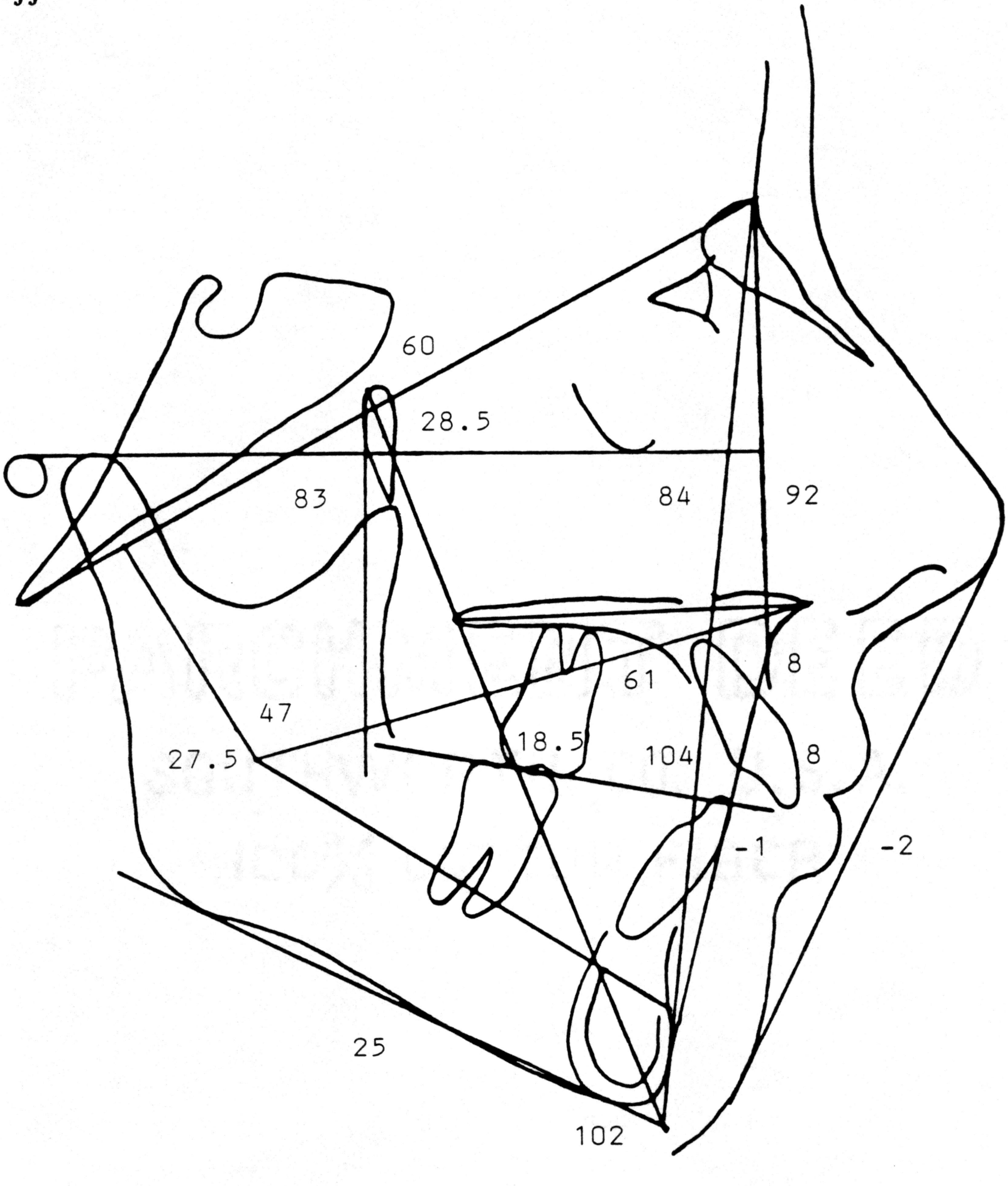

Figure 21

Patient # 4
Female, Caucasian
Age 12-7
Post-JJ

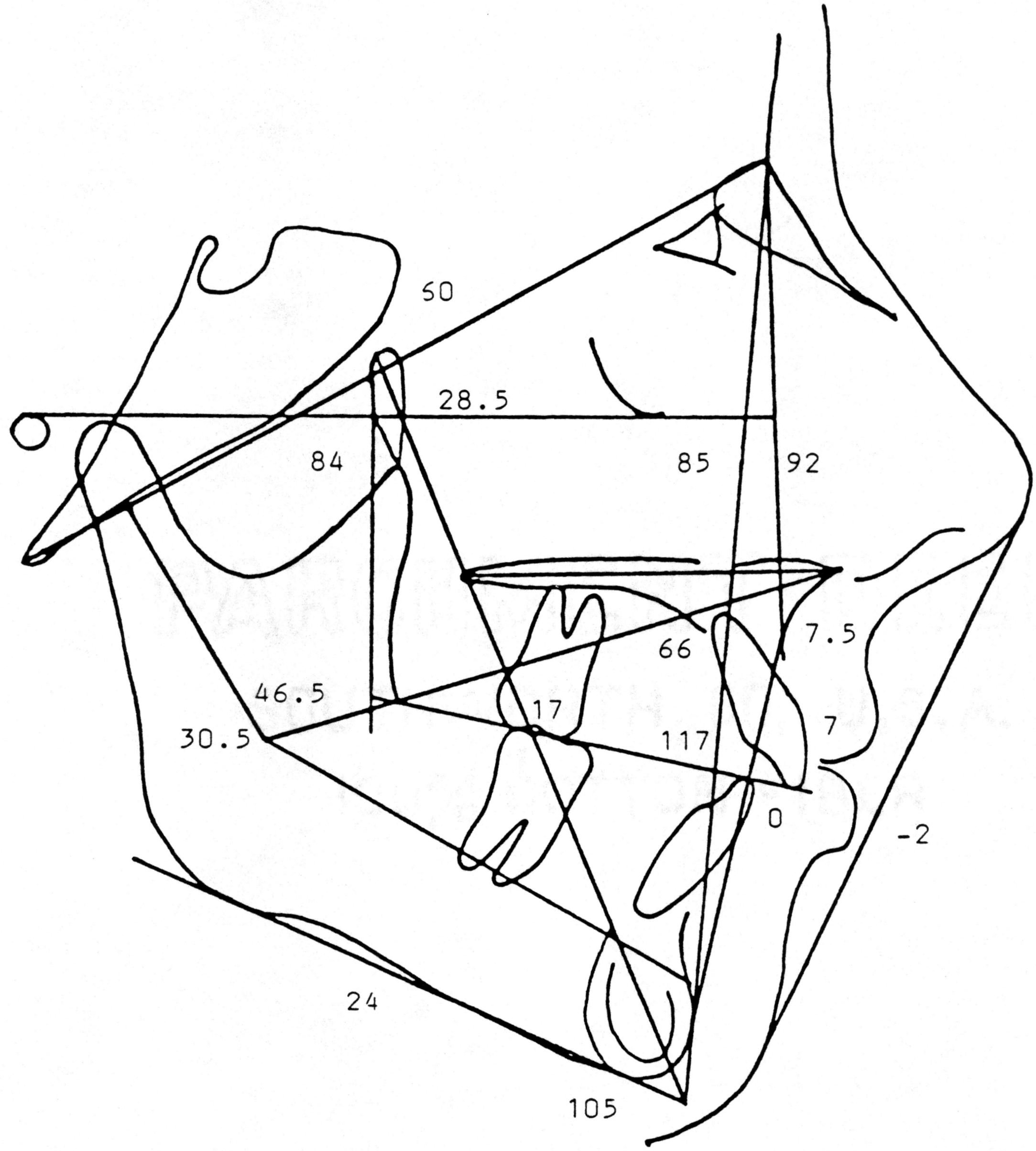

Figure 22

Patient # 4
Superimpositions
Pre ——— Post - - - - -

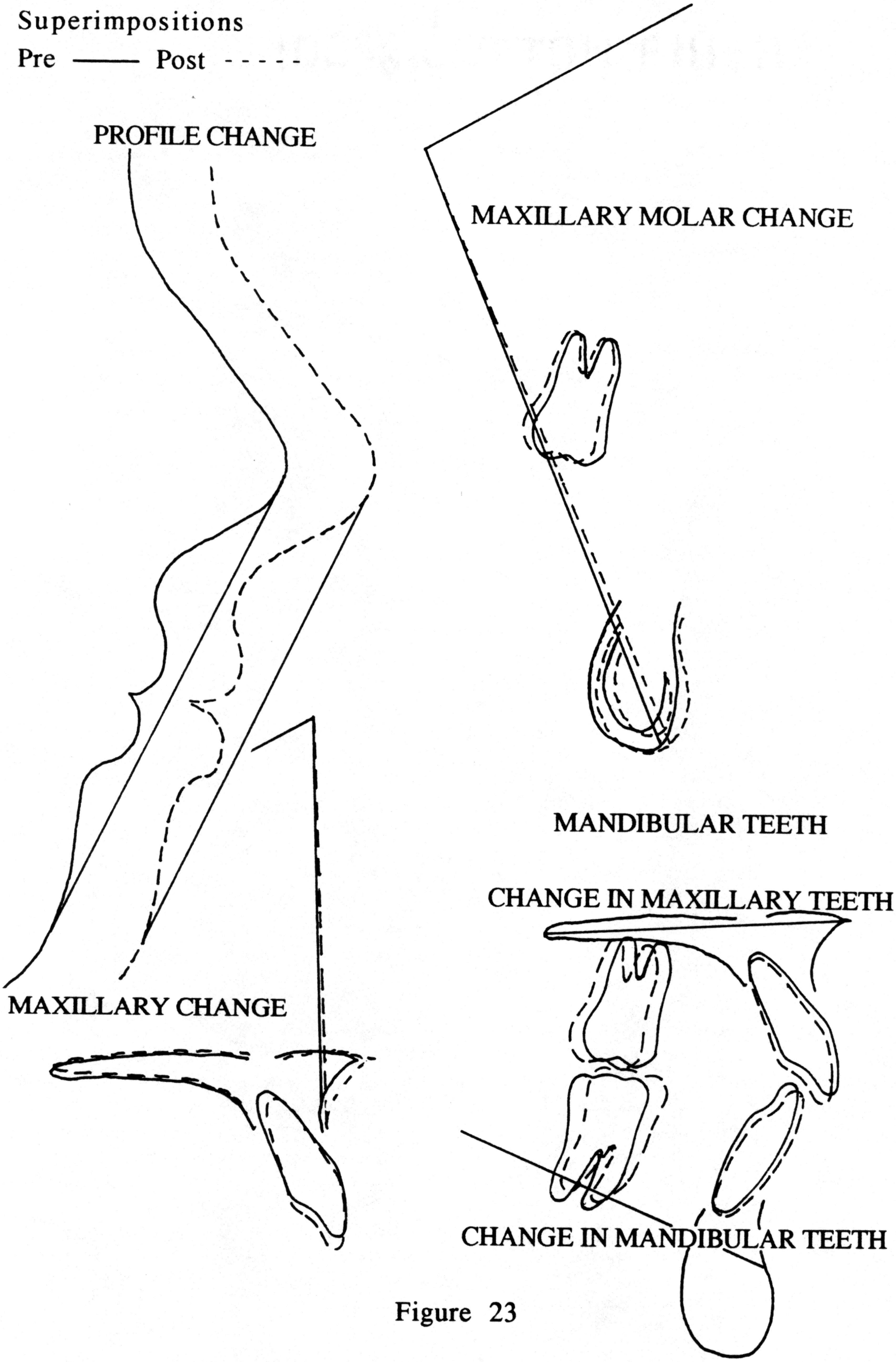

Figure 23

Patient # 6
Female, Hispanic
Age 12-4
Pre-JJ
(corrected
measurements)

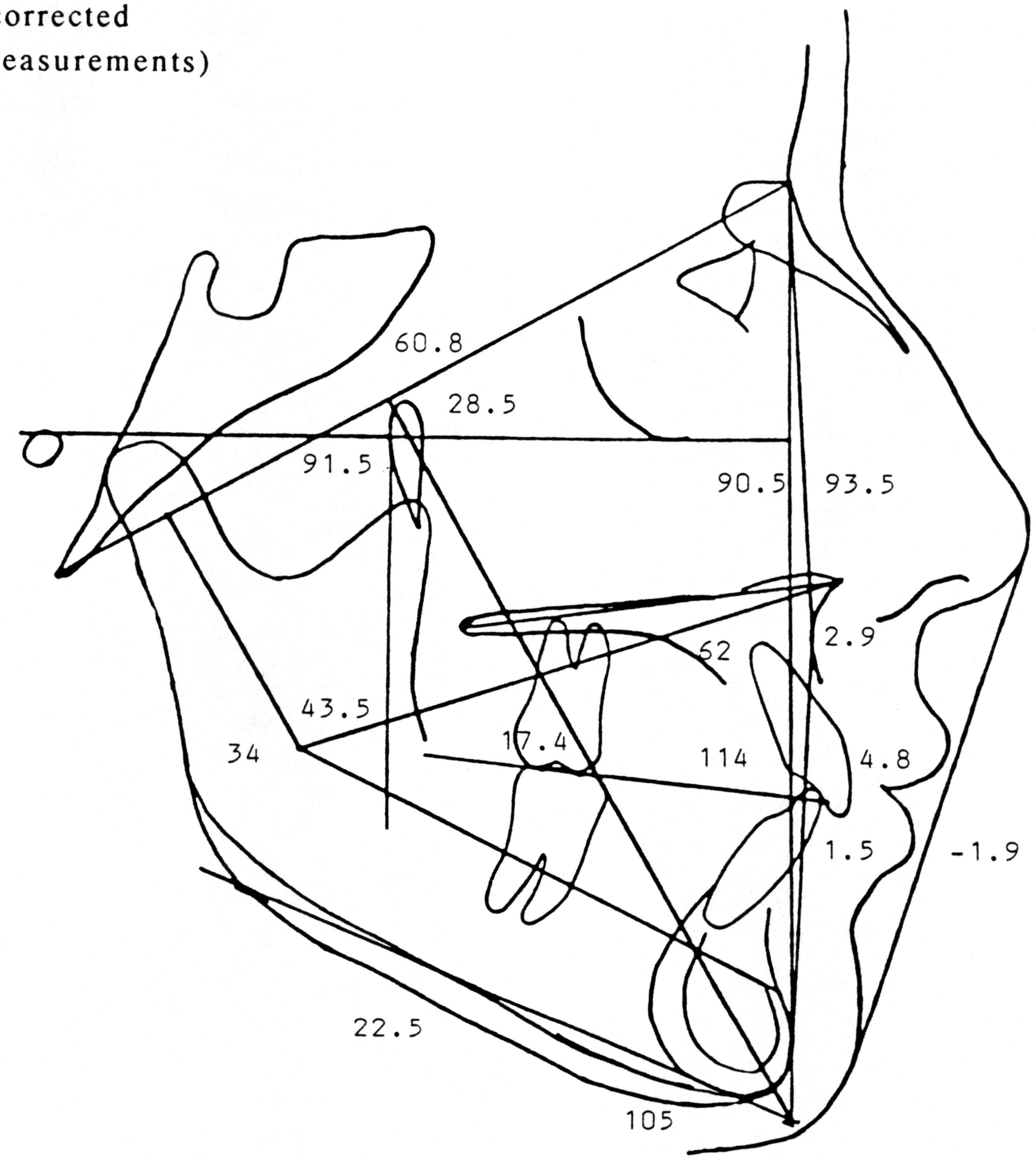

Figure 24

Patient # 6
Female, Hispanic
Age 12-9
Post-JJ
(corrected measurements)

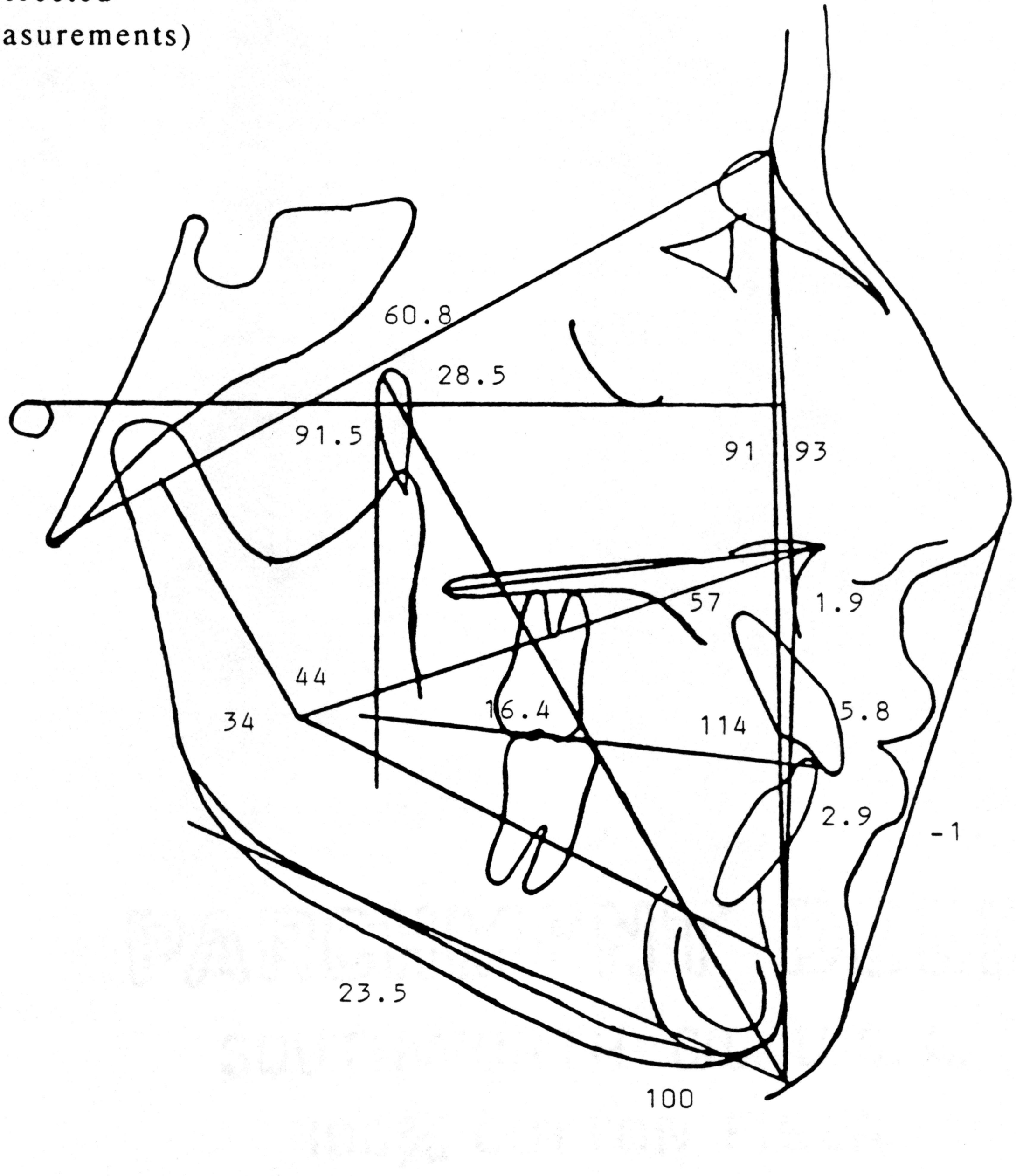

Figure 25

Patient # 6
Superimpositions
Pre ——— Post - - - - -

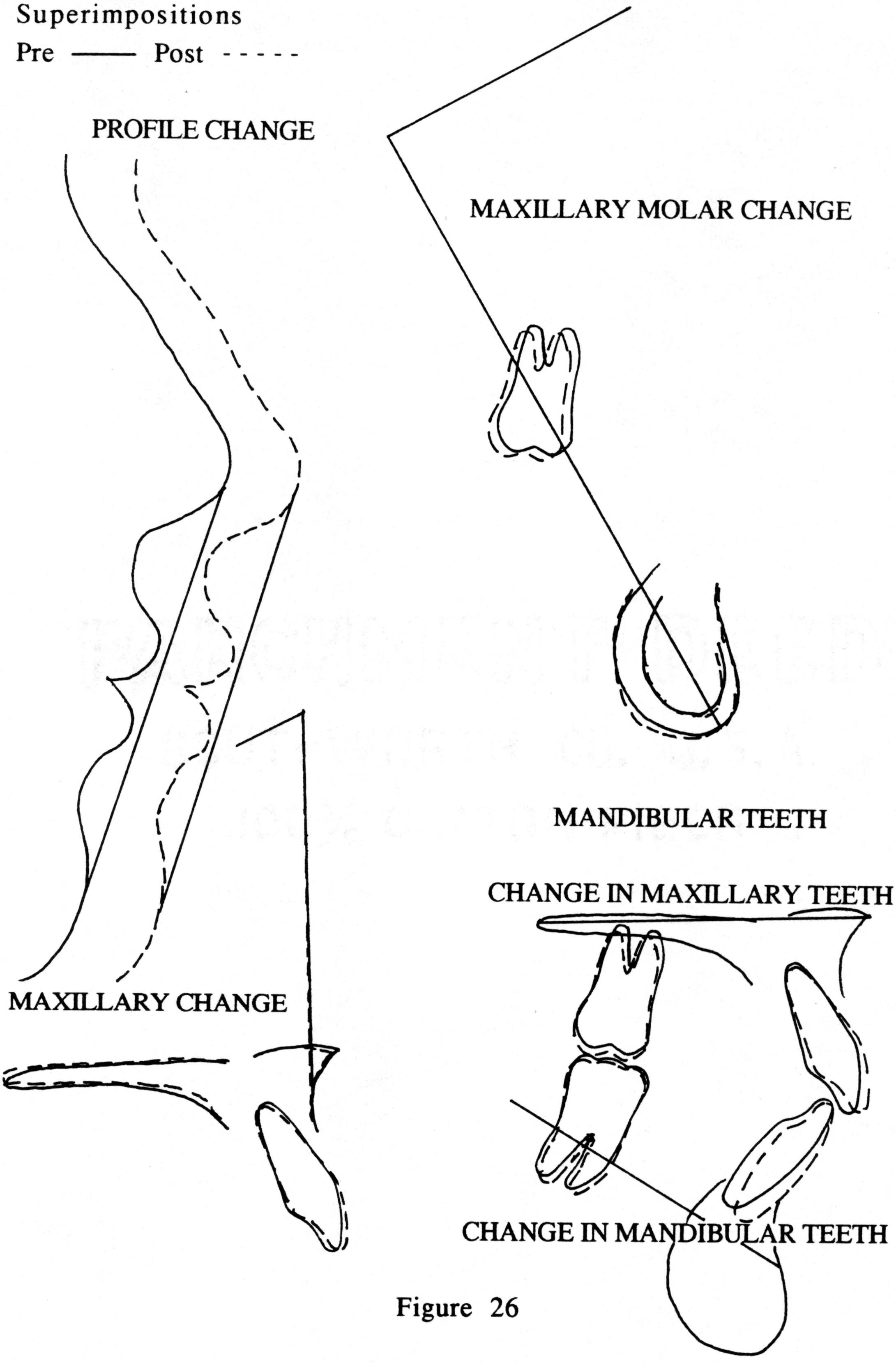

Figure 26

Patient # 7
Male, Caucasian
Age 13-5
Pre-JJ
(corrected
measurements)

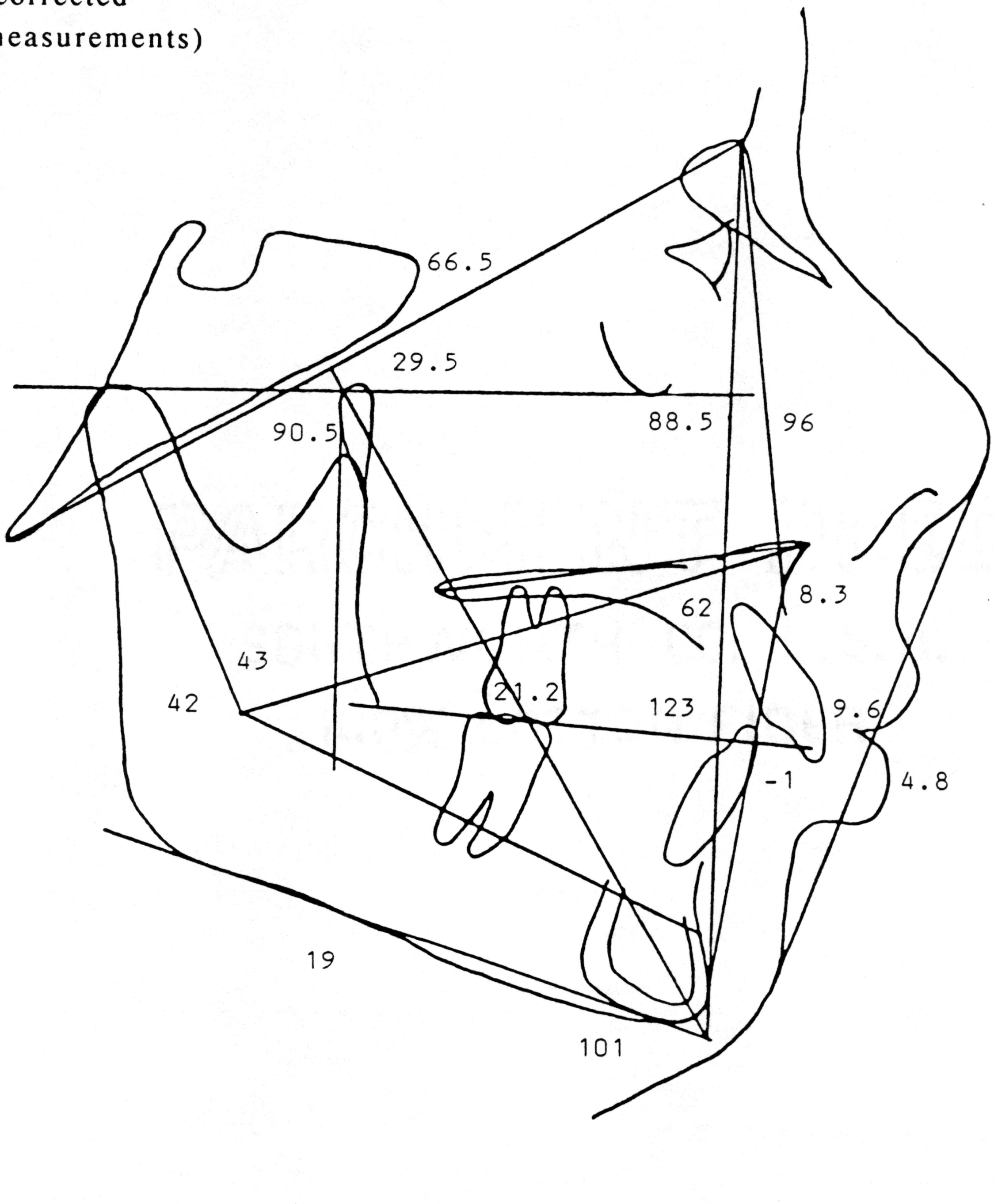

Figure 27

Patient # 7
Male, Caucasian
Age 14-0
Post-JJ
(corrected
measurements)

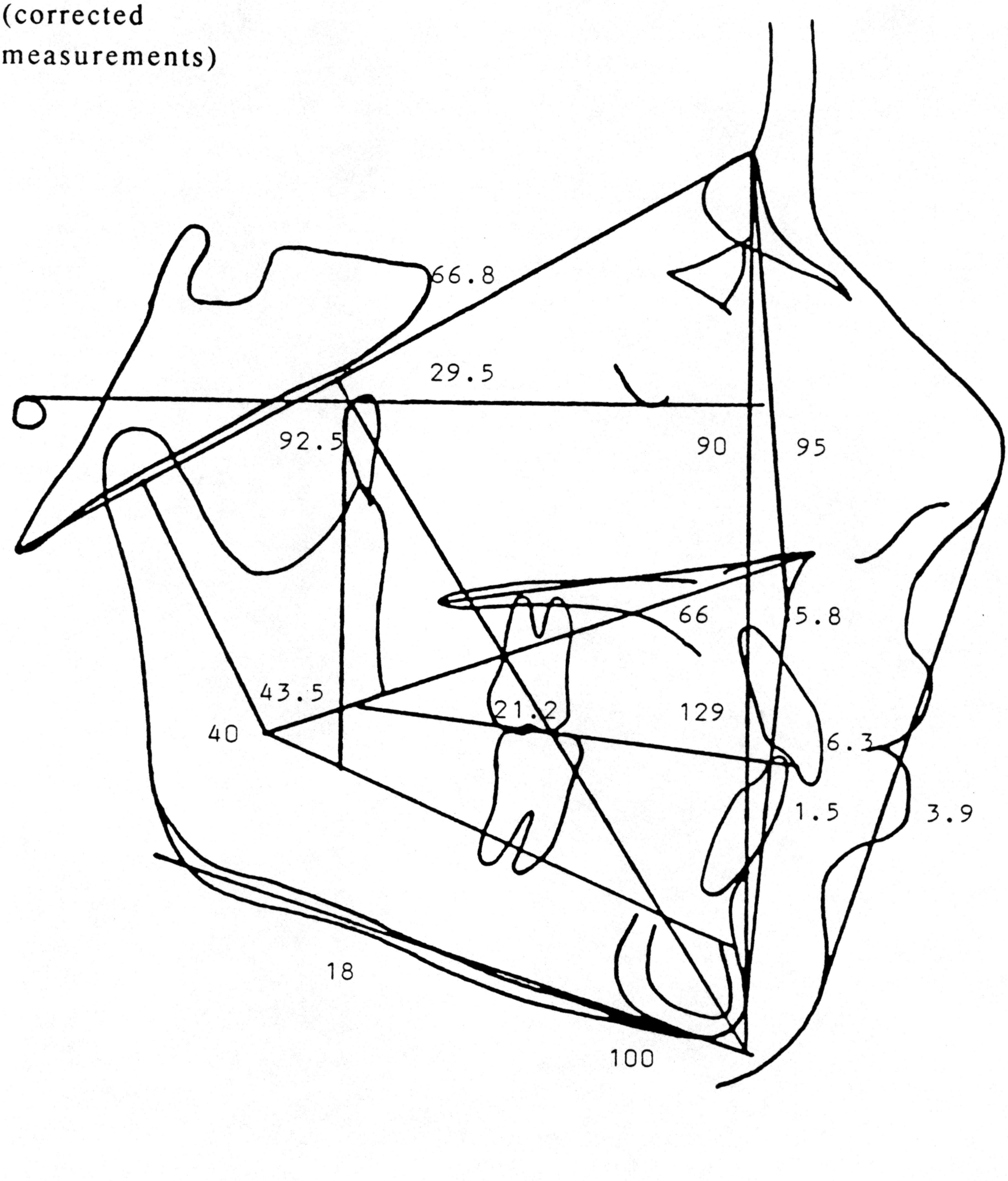

Figure 28

Patient # 7
Superimpositions
Pre ——— Post - - - - -

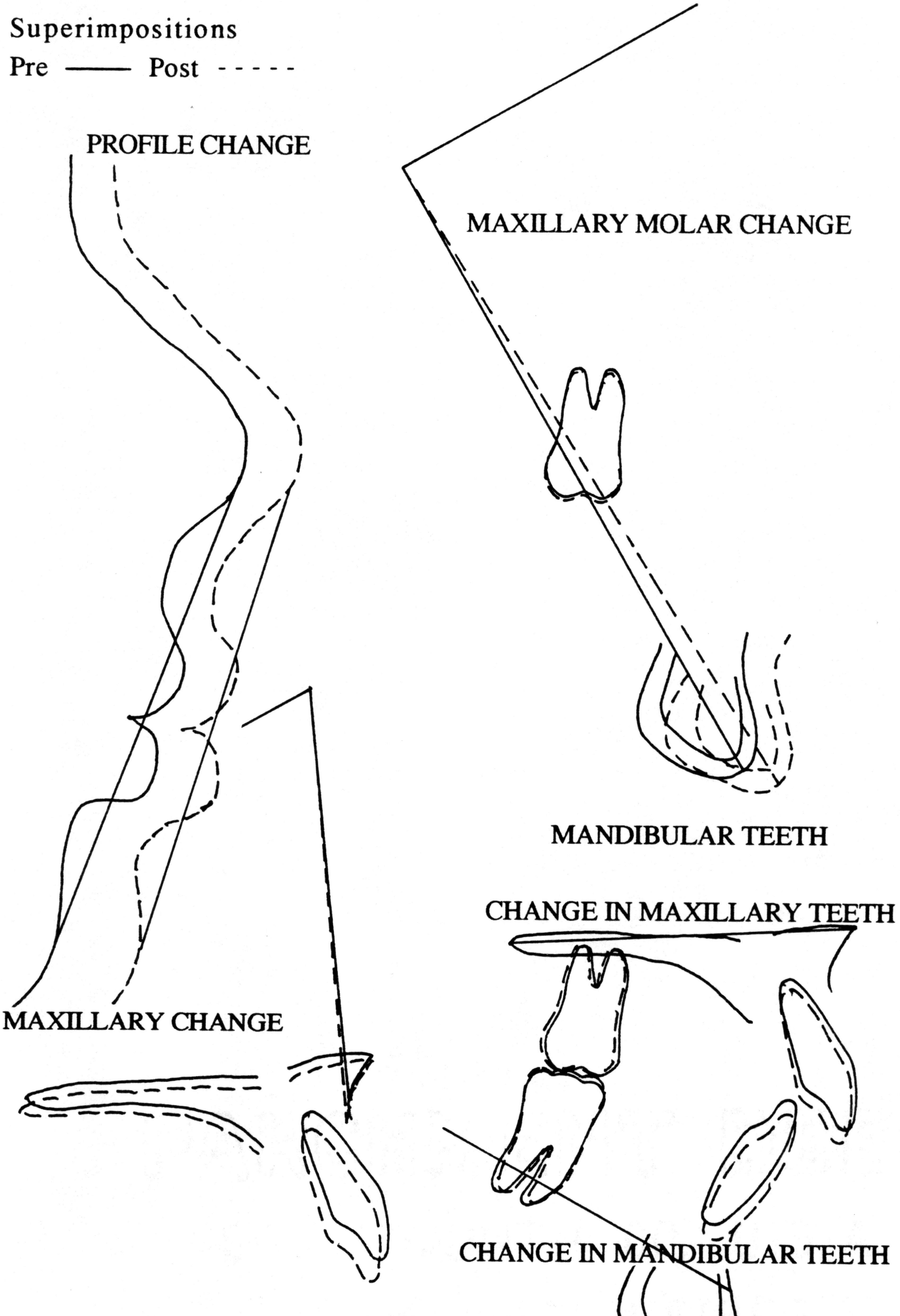

Figure 29

Patient # 8
Male, Caucasian
Age 16-4
Pre-JJ
(corrected
measurements)

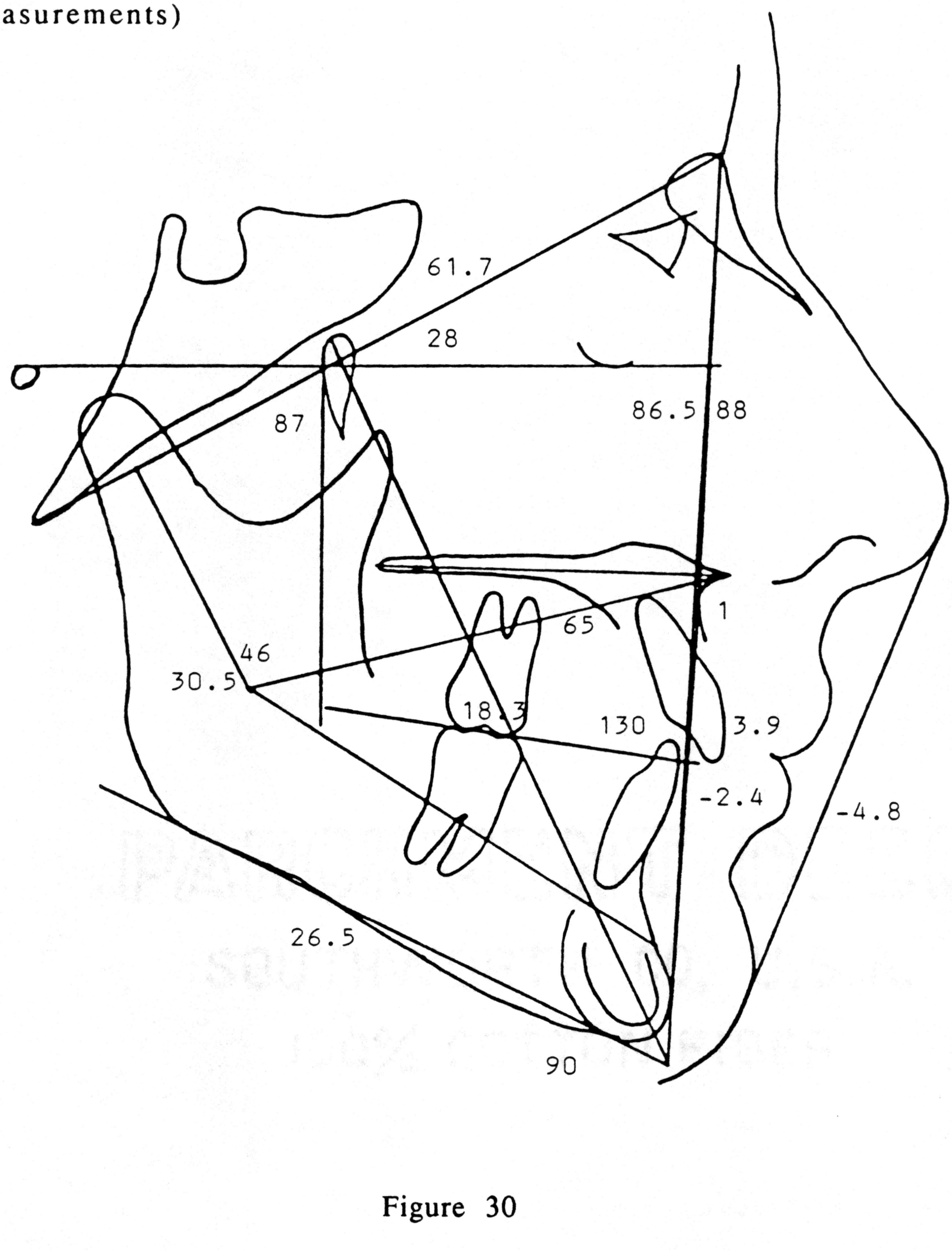

Figure 30

Patient # 8
Male, Caucasian
Age 16-11
Post-JJ
(corrected
measurements)

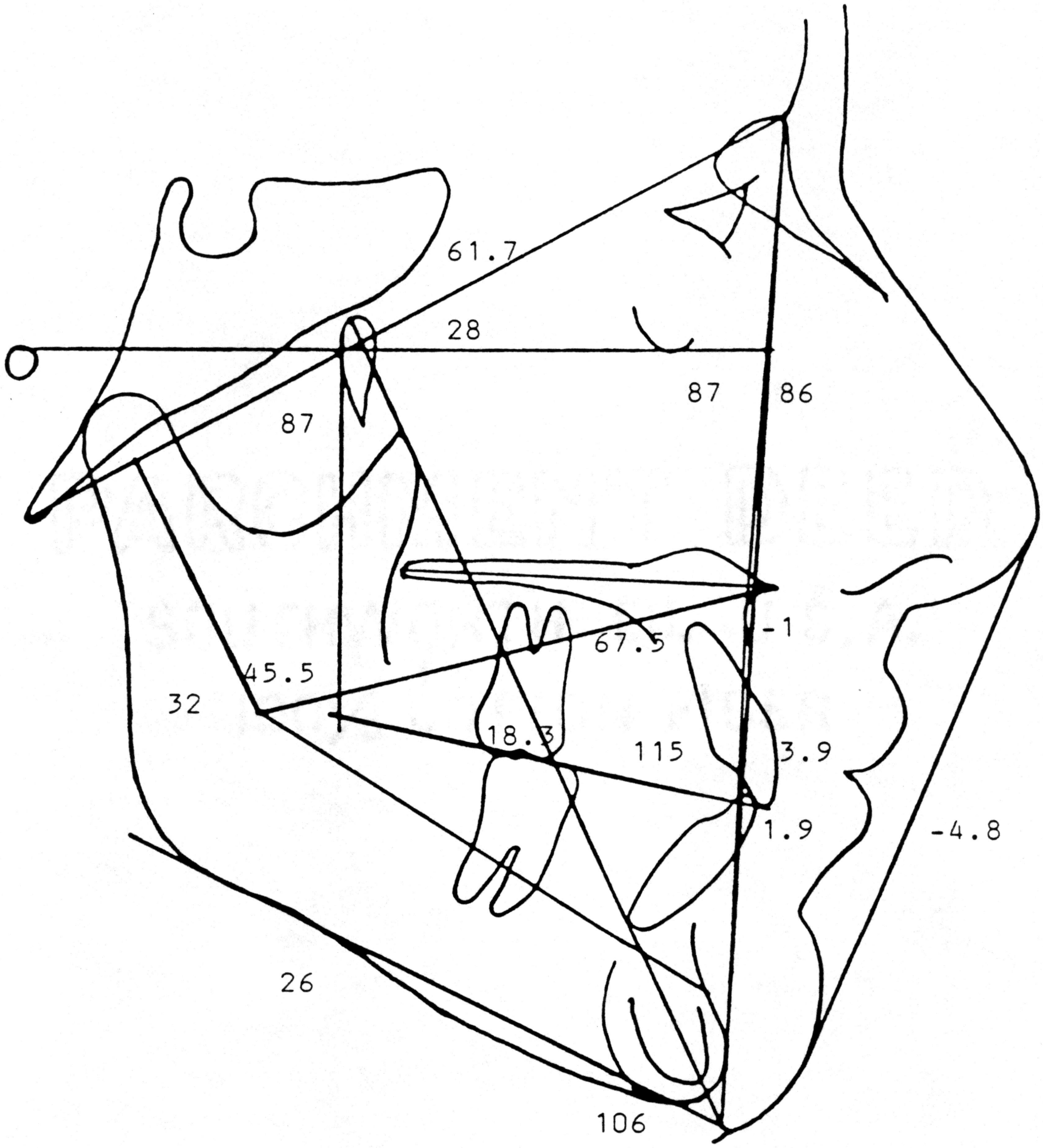

Figure 31

Patient # 8
Superimpositions
Pre ——— Post - - - - -

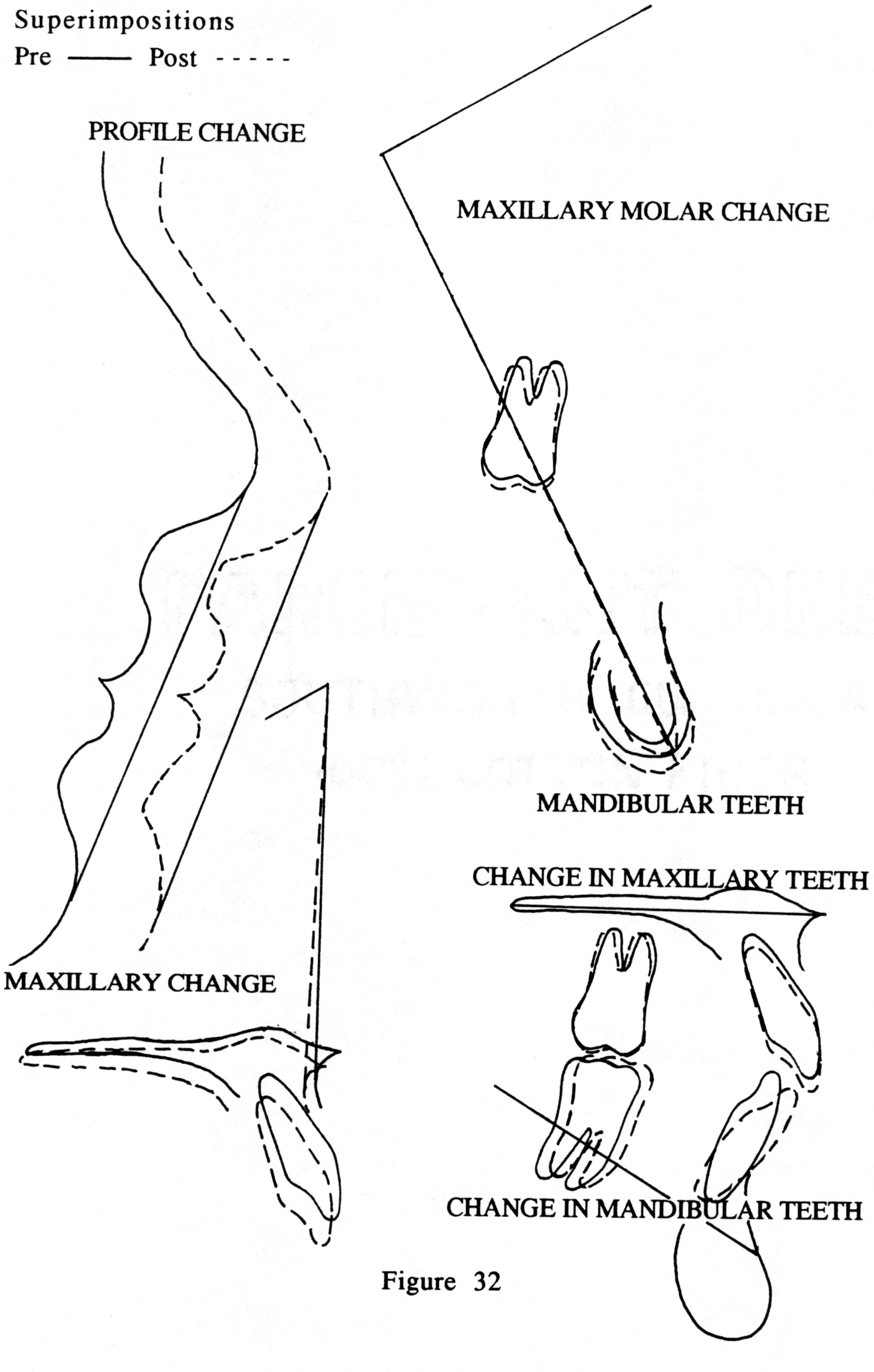

Figure 32

Patient # 9
Male, Caucasian
Age 13-4
Pre-JJ
(corrected
measurements)

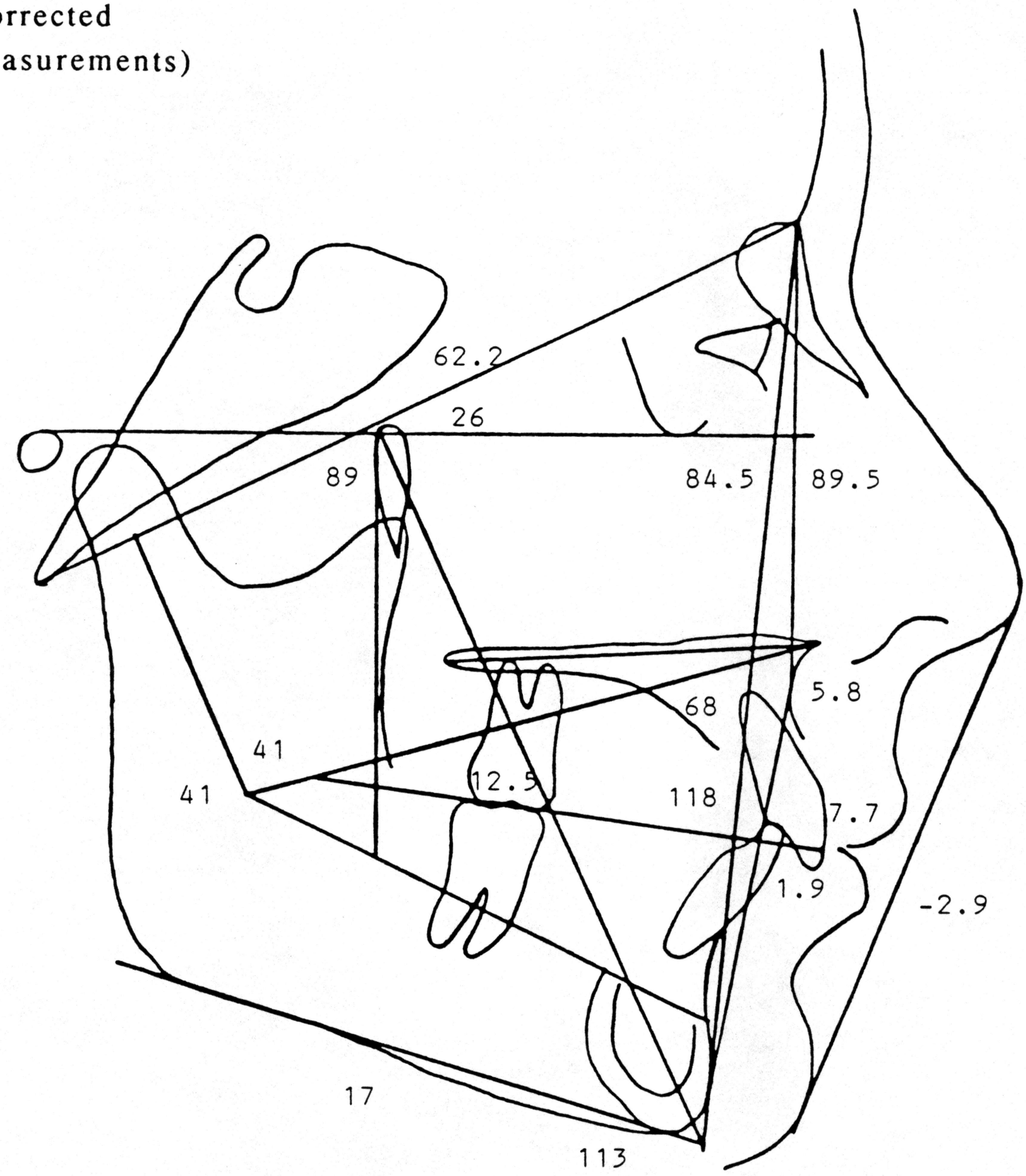

Figure 33

Patient # 9
Male, Caucasian
Age 13-9
Post-JJ
(corrected
measurements)

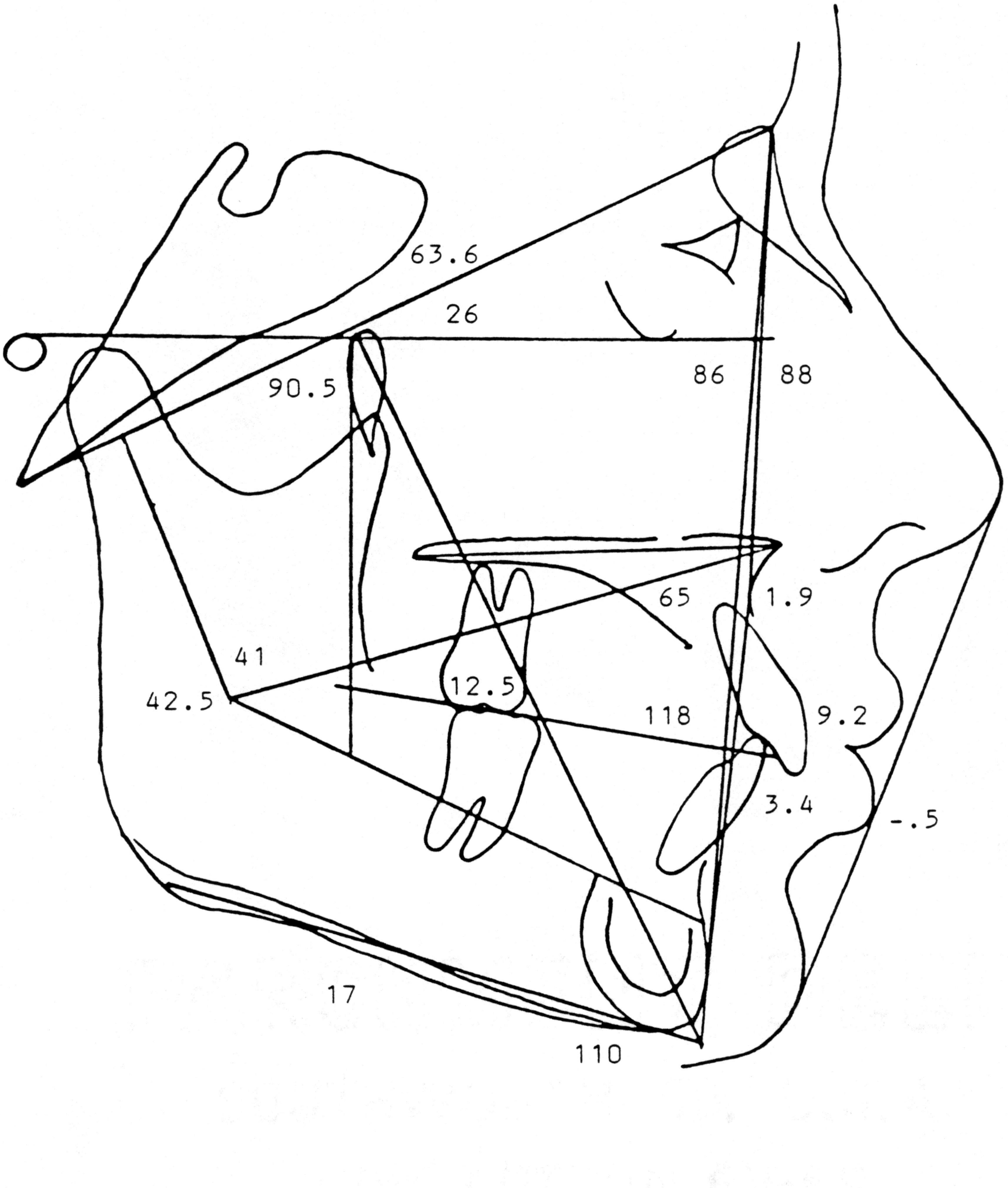

Figure 34

Patient # 9
Superimpositions
Pre ——— Post - - - - -

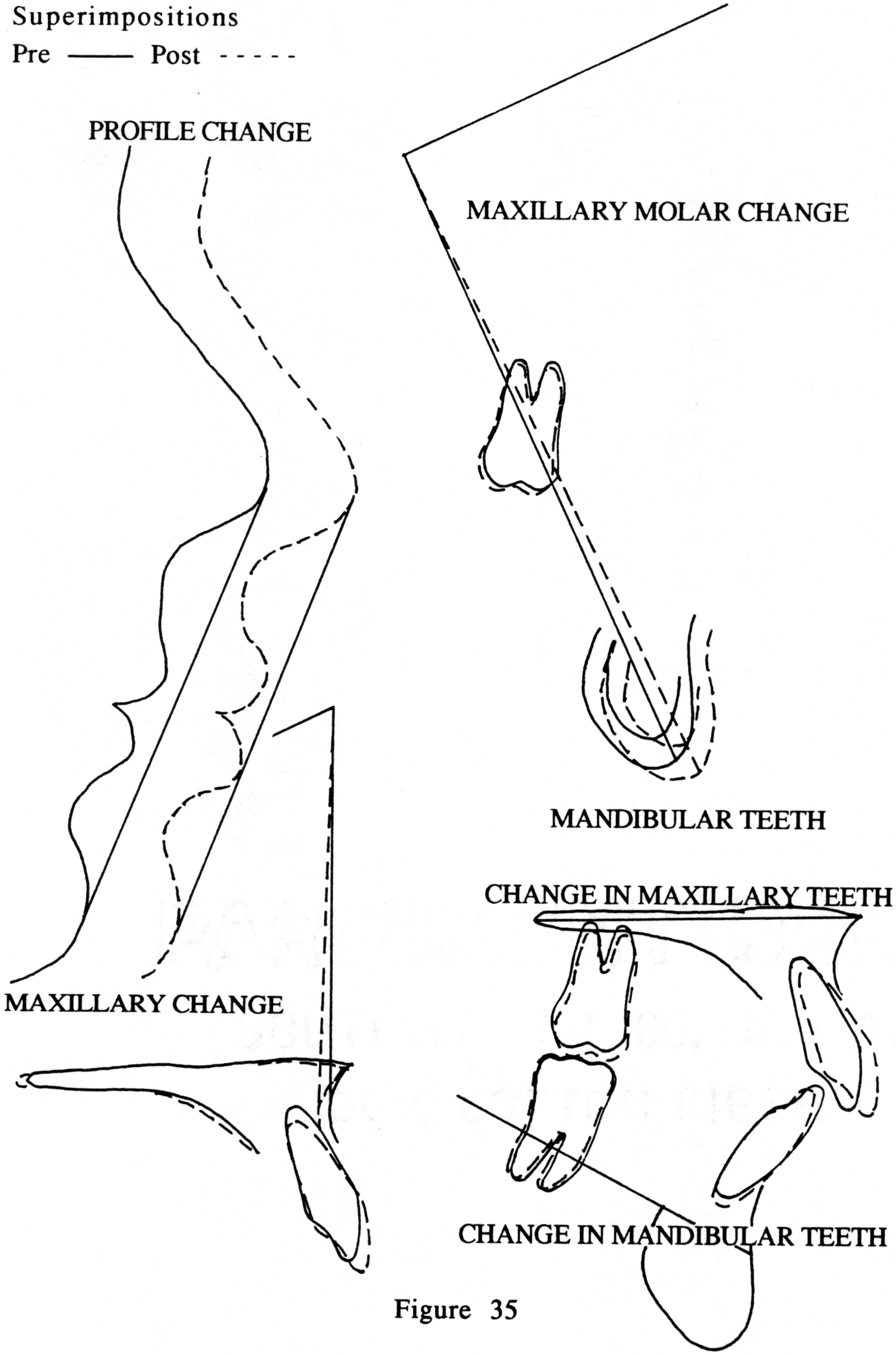

Figure 35

Patient # 10
Female, Caucasian
Age 12-9
Pre-JJ
(corrected
measurements)

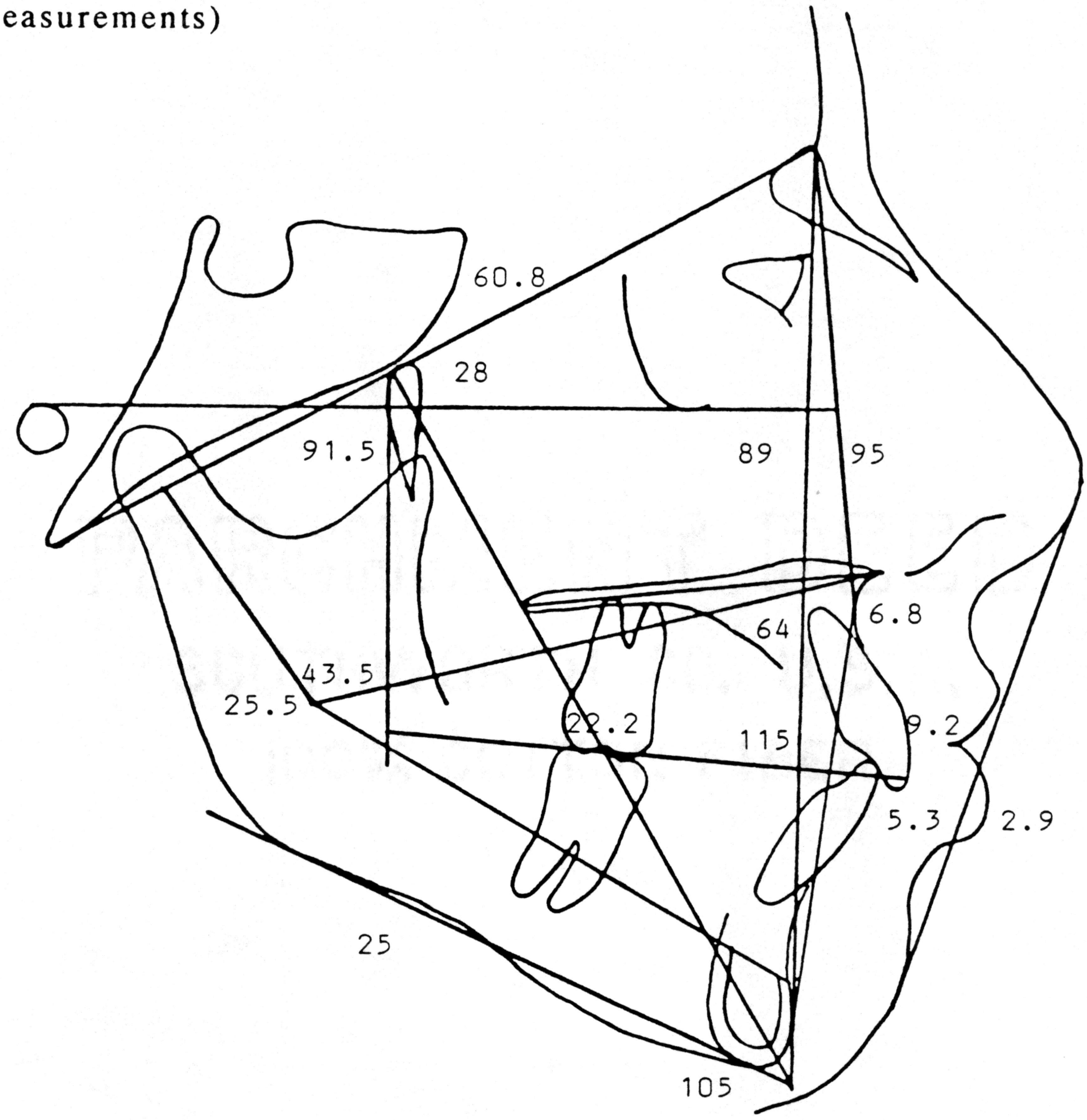

Figure 36

Patient # 10
Female, Caucasian
Age 13-1
Post-JJ
(corrected
measurements)

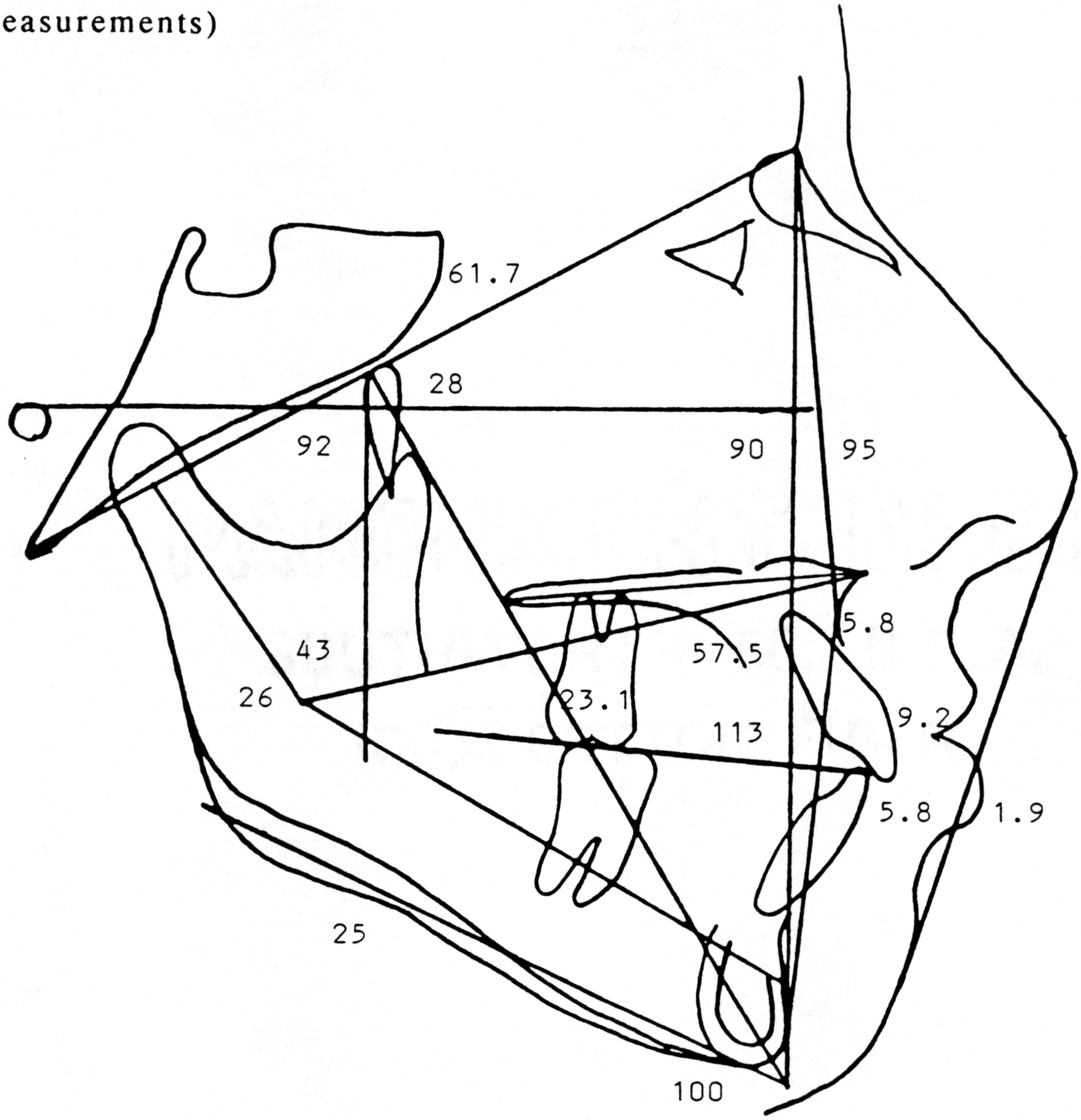

Figure 37

Patient # 10
Superimpositions
Pre —— Post - - - - -

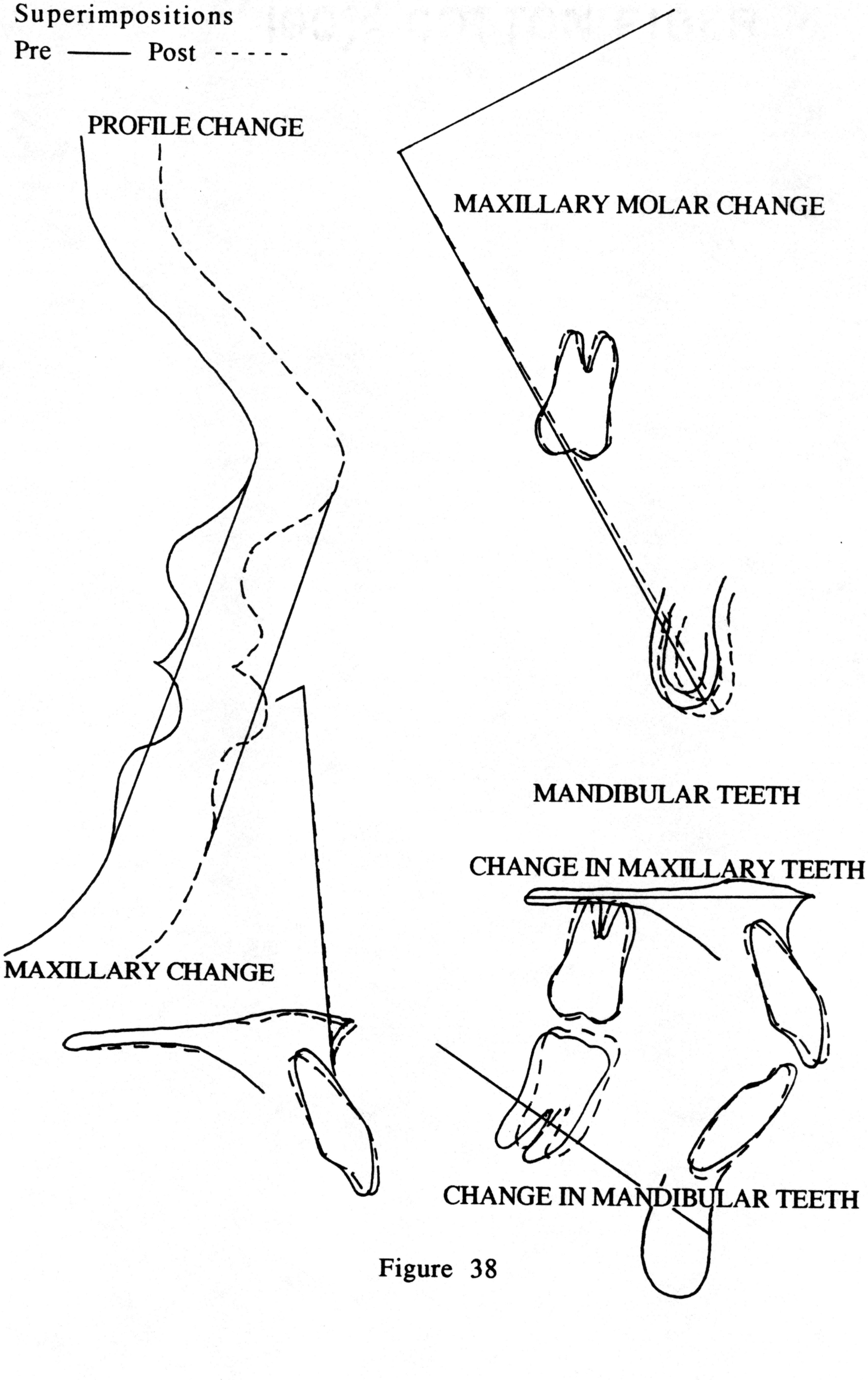

Figure 38

REFERENCES

1. Ricketts, R.M., et al.: Bioprogressive Therapy. Denver, 1979, Rocky Mountain Orthodontics.

2. Jacobson, A.: A key to understanding extraoral forces. Am J Orthod 1979; 75:361-386

3. Proffit, W.R.: Contemporary Orthodontics. St. Louis, 1986, C.V. Mosby Company, 425-427

4. McNamara, J.A., Carlson, D.S.: Quantitatiive Analysis of Temporomandibular Joint Adaptations to Protrusive Function. Am J Orthod1979; 76:593-611.

5. Emmerson, W.: Activator Growth Augmentation - A Long-term Perspective. Master's Thesis, Loma Linda University, 1982.

6. Proffit, W.R..: Contemporary Orthodontics. St. Louis, 1986, C.V. Mosby Company, 357-366

7. Pancherz, H.: The mechanism of Class II correction in Herbst appliance treatment: a cephalometric investigation. Am J Orthod 1982; 82:104-113.

8. Dischinger, T.G.: Edgewise Bioprogressive Herbst Appliance. J Clin Orthod 1989; 23:608-617.

9. Jasper, J.: Lecture to Washington state Orthodontic Society study club, Ist quarter 1989, Videotape.

10. Jasper Jumper instruction manual distributed by American Orthodontics with Jasper Jumper kits.

11. Cash, R.G.: Case Report - Adult Nonextraction Treatment with a Jasper Jumper. J Clin Orthod 1991; 25:43-47.

12. Blackwood III, H.O.: Clinical Management of the Jasper Jumper. J Clin Orthod 1976; 25:755-760.

13. Daniel, W.W.: Biostatistics: A foundation for analysis in the health services, Fourth Edition. New York, 1987, John Wiley & Sons.

14. Jasper, J.: Lecture to Loma Linda University Orthodontic Residents, Feb. 18, 1988, Videotape.

15. Baumrind, S., Franz, R.C.: The reliability of headfilm measurements, 1. Landmark identification. Am J Orthod 1971; 60:111-127.

16. Pancherz, H.: The Nature of Class II relapse after Herbst appliance: A cephalometric long-term investigation. Am J Orthod 1991; 100:220-233.

17. Weinbach, J.R., Smith, R.J.: Cephalometric changes during treatment with the open bite bionator. Am J Orthod 1992; 101:367-374