5-1972

A Clinical Evaluation of Space Closure and Anchorage Loss in Stage I and II Begg Treatment

William G. Byrne

LOMA LINDA UNIVERSITY

Graduate School

A CLINICAL EVALUATION OF SPACE CLOSURE AND ANCHORAGE LOSS IN STAGE I AND II BEGG TREATMENT

by

William G. Byrne

A Thesis in Partial Fulfillment

of the Requirements for the Degree

Master of Science in the Field of Orthodontics

May 1972

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

Roland D. Walters, Chairman
Roland D. Walters, Associate Professor of Orthodontics

John P. DeVincenzo, Associate Professor of Orthodontics

Jack L. Tomlinson, Assistant Professor of Orthodontics

Peter C. Kao, Visiting Lecturer, Department of Orthodontics

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to the members of his guidance committee and all those having any part in the preparation of this thesis. He particularly takes pleasure in this opportunity to express his gratitude to Dr. John P. DeVincenzo whose encouragement, guidance, and constructive criticisms have been invaluable throughout the course of this investigation.

Appreciation is also owing to Dr. Roland D. Walters whose courage and confidence made this study possible, and to Dr. Jack L. Tomlinson for his invaluable aid and time in helping with the data analysis.

The author wishes to thank the Kesling and Rocke Orthodontic Center for their gracious hospitality and for their aid in the diagnosis and treatment planning of the clinical cases used in this study.

A special note of thanks is given to Dr. Peter C. Kao for his instruction and guidance of the clinical portion of this study. His great humility and Christian love has touched us all.

To Christy, Bob, and Ed for years of love and understanding.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

NOTICE

The following manuscript was prepared as a partial fulfillment of the requirements for a graduate degree from Loma Linda University Graduate School under the discipline of the School of Dentistry.

While the format in general is governed by the criteria of a conventional Graduate School Thesis, it is in actuality a manuscript which is readily amenable for publication in a scientific journal.

CHAPTER I

INTRODUCTION

There has been controversy about the Begg technique since its introduction in this country. This controversy has focused on the biomechanics of this treatment concept, specific tissue reactions to the "light wire technique", the speed, ease, chair time and patient comfort experienced in its use, and the completed tooth positions and facial profiles accomplished.

The mechanics of the light wire concept are based upon the premise that there is an optimum light continuous force which produces the most rapid tooth movement with the least disturbance to investing tissues and anchorage loss.[4, 5, 23, 24, 25, 28, 31, 33] Begg[4] has stated that anchorage is maintained because the light forces produced leave the large-rooted posterior anchor teeth almost stationary while the anterior teeth are rapidly retracted. Begg has called this the differential force principle, and advocates of the technique state that there is no need for extra oral anchorage because of its effectiveness.[4, 6, 7, 8, 9, 10, 19, 22, 32] Several studies, however, have indicated that one can expect considerable anchorage loss in Begg treated cases.[11, 12, 14] Also, data have appeared recently which conflict with the concept of "optimum force".[2, 16, 17, 35]

Statements have been made regarding a decrease in the incidence and severity of apical root loss of permanent teeth treated by "light

wire" techniques.[18] Gaudet[13] showed little root resorption when using the Begg technique when forces were kept under four ounces. He further showed a significant increase in root resorption when forces were increased to seven ounces. In contrast, Parker[26] showed that the tipping of maxillary incisors caused the apicies to move against the labial periostium resulting in increased resorption. Many statements have also been made that the Begg technique produces little or no patient discomfort;[8, 32] however, a survey of the literature shows no data to support these clinical observations.

Some clinicians have stated that the Begg technique reduces chair time and total treatment time.[4, 5, 8, 20, 30, 32, 34, 36] Parker,[27] in contrast, found an increase in chair and total treatment time for Begg when compared with edgewise cases.

There have been many cephalometric studies of treatment results reported in the literature. Again the data are conflicting. Some authors have shown no increase in mandibular plane angle in Begg treated cases.[3, 15, 20, 22, 30] Other authors have shown a significant increase in mandibular plane angle and an opening of the Y axis in Begg treated cases.[11, 27, 29] Begg stated that the anterior bite was opened by depression of the maxillary and mandibular incisors.[4] The data are not conclusive. Armento[3] and Allen[1] have shown depression of incisors while Parker[27] and Leno[21] have shown anterior bite opening occuring at the expense of molar extrusion with out incisor intrusion. All authors show a clockwise rotation of the plate in Begg cases but disagree as to the severity and overall effect on the facial profile. 11, 15, 20, 27, 29, 30

The magnitude of the discrepancies found indicate the need for a comprehensive, well controlled, non-biased clinical evaluation of the Begg technique. The purpose of this paper is to present such data from a clinical study of seven Begg treated class I four bicuspid extraction cases from the initiation of treatment through the set-up of third stage mechanics.

CHAPTER II

METHODS AND MATERIALS

Before screening some 700 possible patients, several restrictive criteria were chosen. Patients were to have a Class I molar relationship with the first molars in good occlusion. All cases must require the extraction of four first bicuspids due to either bimaxillary protrusion or tooth size arch length discrepancy. None of the cases could be mutilated. Cases requiring maximum anchorage were preferred. No cases with extreme mandibular plane angles, extreme open or closed bites, or in the mixed dentition stage were selected. Patients with medical problems that could affect treatment or severe habit problems were not selected. Cases without crossbites were given preference. Patients as well as parents must be aware of and agree to cooperate with research protocol. All teeth must be bandable with the exception of unerupted second and third molars.

Operator skill, dexterity, and familiarity with the technique were variables which could affect treatment, and therefore, the results of the study. Thus it was decided that each of seven graduate students was to treat one case under research direction following the Begg philosophy. This would allow comparison of both the objective and subjective parameters outlined in the introduction.

The following data were collected at the beginning of the study and at the end of stage II: Cephalometric lateral head radiographs,

intra-oral periapical radiographs, occlusal radiographs, lateral jaw radiographs, frontal and profile photographs, and plaster models. Progress models were also taken at the end of Stage I. Space closure was determined completed when an .012 wire loop would not pass between the cuspids and second bicuspids.

In order to establish a point of reference from which to measure, all patients were tattooed at the arbitrary hinge axis which was located approximately 8mm. anterior to the tragus of the ear on a line from the tragus to the outer canthus of the eye. The tattoo was placed just under the skin with a disposable 30-guage needle dipped in black India ink (Figure 1). Maxillary and mandibular cuspids and first molars were marked by placing a small dimple on the gingival labial surfaces with a high speed bur (Figure 2). Movement of the cuspids, molars, and B point was measured with specially designed calipers using the hinge axis tattoo as a stable reference point (Figure 3). The extraction space was double checked by a measurement made from one-to-one maxillary and mandibular occlusal photographs (Figure 4). The photographs were taken with a special Polaroid-type camera which allows insertion of the lens directly over the occlusal plane (Figure 5).

At four-week intervals the following records were taken: Frontal and side view open and closed position Kodachrome slides of the dentition and appliance, and intraoral occlusal Polaroid prints from which cuspid and anterior space closure were measured as described above and shown on Figure 4. Three repetetive measurements were made, with the patient closing on two cellulose pads, from the tattooed hinge axis to each of the cuspids and to B point. All were

recorded and the mean was used for calculations. Measurements from the cuspids to the molar were made with calipers as shown in Figure 6.

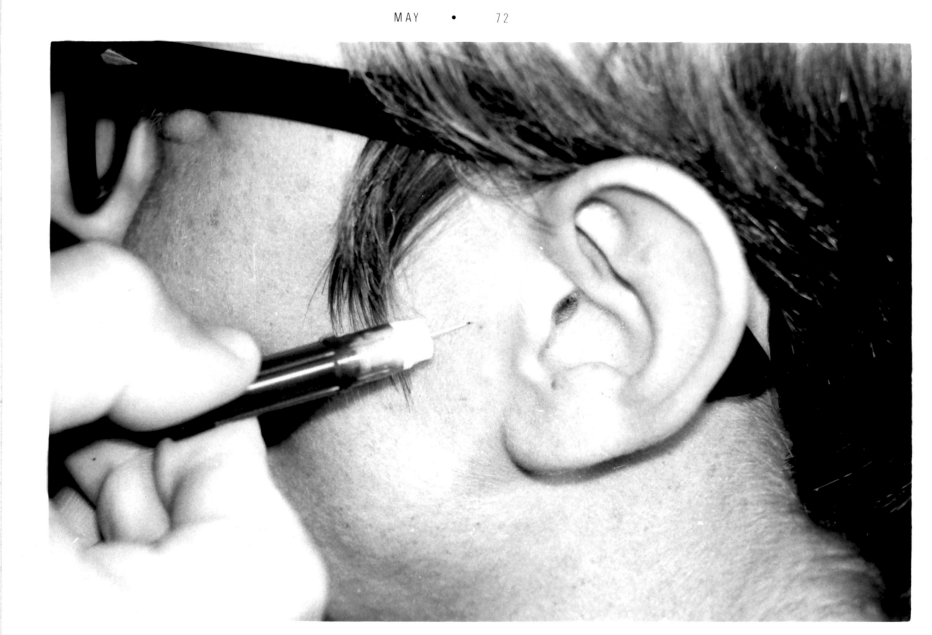
At the time of each appliance adjustment, various objective and subjective measurements were made. All elastic forces were closely measured before and after each activation. On a scale of 1 (little pain) to 5 (severe pain), patients were required to evaluate pain after and between adjustments. Patients were also requested to report in days the duration of the pain. Difficulty of each adjustment was recorded by each operator on a scale 1 (very easy) to 5 (very difficult). The total time in minutes for each adjustment and the frequency of adjustments were also noted. Rotations, extrusion, tipping, tissue irritation, and other impressions about the appliance and technique were recorded at each adjustment on the data sheet shown in Figure 7.

The cuspid-second bicuspid angle was assessed from the intraoral radiographs. A plus angle was defined as one in which the roots apecies would eventually intersect, while a minus value was assigned to root divergence. Lines drawn through all teeth were constructed to run through and parallel to the coronal 2/3 of the pulp chamber, bisecting the cusp tips when possible. When more than one radiograph contained both the cuspid and second bicuspid, all values were taken and a mean determined. Frequently no suitable radiograph showing both teeth was present, in such cases the angle between the cuspid-first bicuspid was recorded from one radiograph and the angle first bicuspid-second bicuspid was measured from a second radiograph. By trigonometric manipulation the cuspid-second bicuspid angle was then calculated. Reproducibility of this technique using both direct measurement and trigonometric manipulation was $\pm$ 8%. Cuspid-second

bicuspid angles were computed for all four quadrants before treatment and at the termination of Stage II. The change in this angle was computed as follows: beginning angle (+or-) - ending angle (+or-) = delta value. A negative delta value would indicate root divergence while a plus value was indicative of root convergence during cuspid retraction.

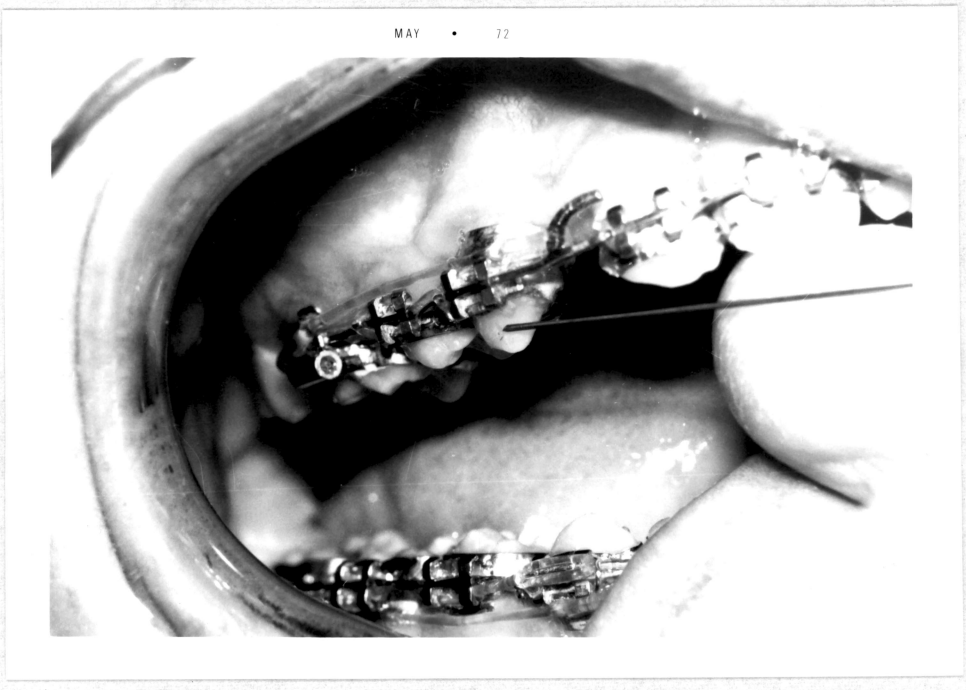
All cases were treated using the Begg "light wire technique" as taught by the Kesling and Rocke Orthodontic Center and under the supervision of Dr. Peter C. Kao of Garden Grove, California. An indirect banding procedure was used and appliances made by T. P. Laboratories. Strict adhearance to the "pure" technique was followed at all times. The following objectives were met during the first stage: 1. Open the anterior overbite, 2. Overcorrect the mesial distal relationship to the buccal segments as necessary, 3. Close any anterior spaces, 4. Eliminate any anterior crowding, 5. Over-rotate all teeth that require rotating, 6. Correct posterior cross-bites. The second stage objectives were: 1. Maintain all corrections achieved during the first stage, 2. Close any remaining posterior spaces. All elastic forces were measured and kept within the pre-scribed 2 1/2 to 3 ounces. Because of the importance of patient cooper-ation to the success of the Begg technique, time was taken at each appointment to instruct the patient in the proper use of elastics and to instill in them the importance of continual wearing of elastics. A portion of each appointment was also allotted to checking and discuss-ing the patient's oral hygiene.

Figure 1



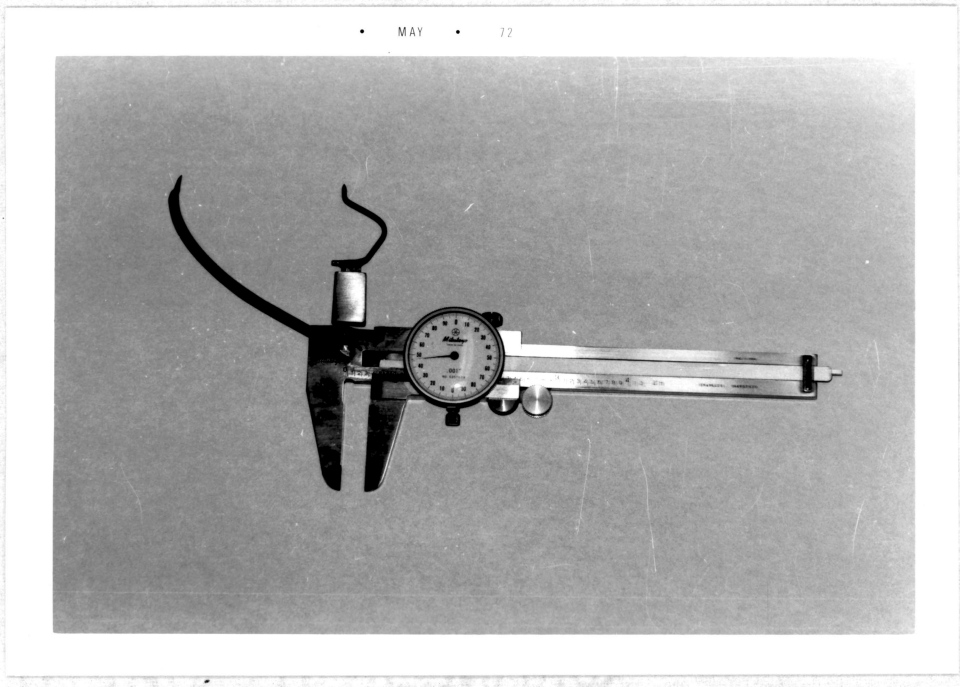
Placement of tattoo at the arbitrary hinge axis.

Figure 2



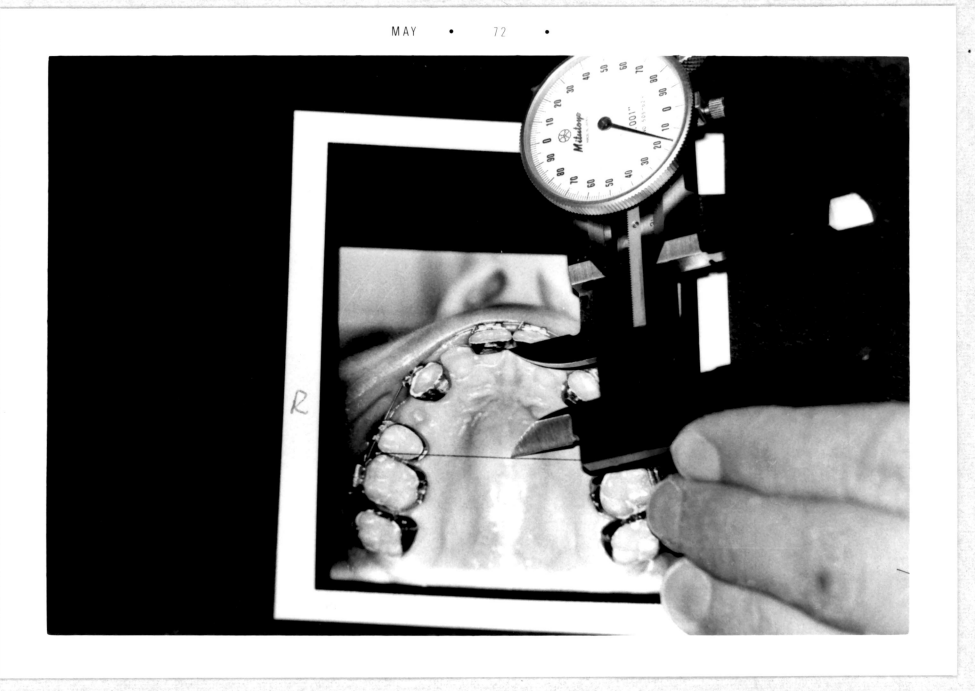
Location of measurement dimple on maxillary cuspids.

Figure 3



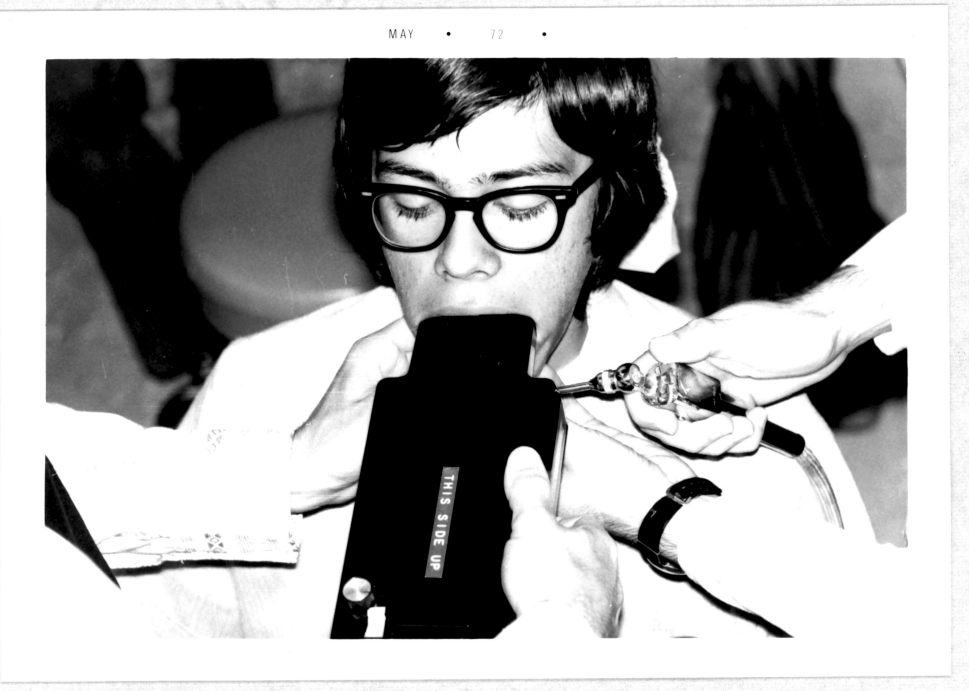
Specially designed calipers used for measurements.

Figure 4



Measurements being taken from a one-to-one photograph.

Figure 5

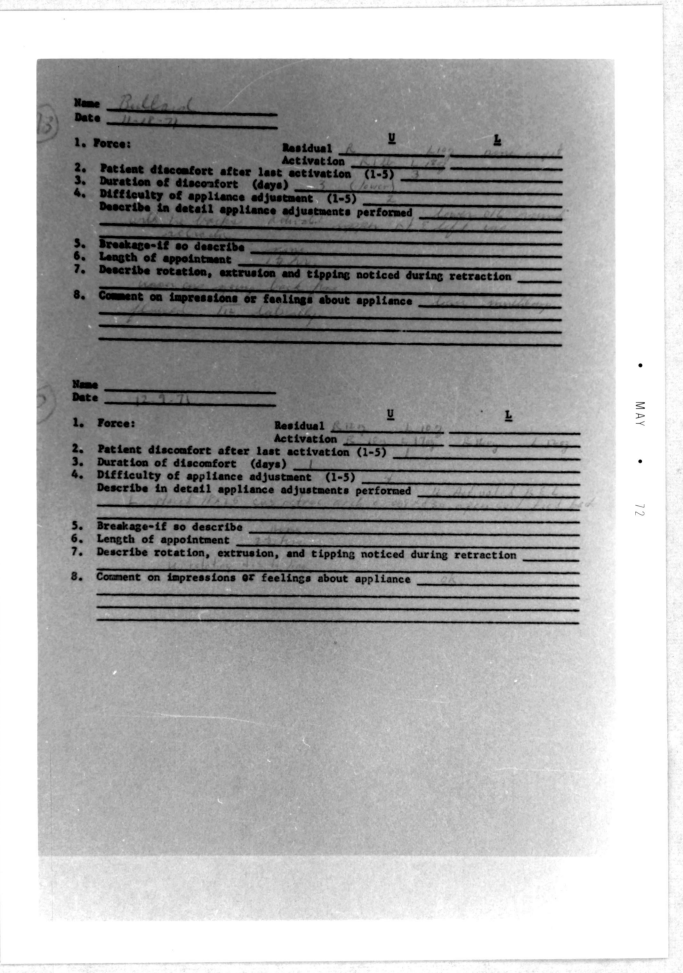


Special one-to-one occlusal Polaroid-type camera in use.

Figure 6

Measurement of ear to cuspid distance.

Figure 7



Name _____
Date _____

		U	L
1. Force:	Residual		
	Activation		

2. Patient discomfort after last activation (1-5) _____
3. Duration of discomfort (days) _____
4. Difficulty of appliance adjustment (1-5) _____
   Describe in detail appliance adjustments performed _____
5. Breakage-if so describe _____
6. Length of appointment _____
7. Describe rotation, extrusion and tipping noticed during retraction _____
8. Comment on impressions or feelings about appliance _____

Name _____
Date _____

		U	L
1. Force:	Residual		
	Activation		

2. Patient discomfort after last activation (1-5) _____
3. Duration of discomfort (days) _____
4. Difficulty of appliance adjustment (1-5) _____
   Describe in detail appliance adjustments performed _____
5. Breakage-if so describe _____
6. Length of appointment _____
7. Describe rotation, extrusion, and tipping noticed during retraction _____
8. Comment on impressions or feelings about appliance _____

• MAY • 72

Sample data collection sheet.

CHAPTER III

RESULTS

The data for rates of anterior retraction and anchorage loss are presented in Tables I through III. Tables IV through VI show the relationship of anterior retraction and anchorage loss in terms of percent of total space closed. Cephalometric values for the beginning of treatment and the end of Stage II are presented in Table VII. The angular relationship between cuspids and second bicuspids for the beginning of treatment and the end of Stage II are given in Table VIII. The changes in skeletal height over the treatment period are given in Table IX, and the changes in SN length for the treatment period are given in Table X.

The mean number of treatment appointments was 8.8± .6. The mean length of each appointment was 45± 5 min. The mean treatment time for Stage I was 3.3 months with a range of 2.5 to 5.5 months. The mean treatment time for Stage II was 4.4 months with a range of 1 to 6.5 months. The mean total treatment time for Stage I and II was 7.7 months with a range of 4.5 to 9.6 months.

The result of the patient discomfort scale (1 little pain to 5 severe pain) was a mean of 1.0± .2. The mean length of such pain was 2± 1 days. The scale of operator difficulty (1 very easy to 5 very difficult) gave a mean result of 1.4± .1. There was no observable root resorption in any of the seven cases on periapical radiographs taken at the end of Stage II.

TABLE I

RATE OF MAXILLARY SPACE CLOSURE *

	Rate of anterior retraction (measured at the cuspid)			Rate of molar movement		
Patient	Stage I	Stage II	Comb.	Stage I	Stage II	Comb.
1	.8**	.3	.5	.3	.4	.4
2	.4	.1	.3	.7	.5	.6
3	.6	-.2	.2	.2	1.4	.8
4	.9	2.3	1.6	.5	-1.8	-.7
5	.02	.4	.2	.4	.3	.4
6	.07	.3	.2	-.02	.2	.1
7	.5	.3	.4	-.1	.7	.3
Mean	.5±.1	.5±.1	.5±.1	.3±.1	.2±.3	.3±.2

* Measurements in mm. per month
**A positive measurement indicates distal movement of anteriors and mesial movement of molars. A negative measurement indicates mesial movement of anteriors and distal movement of molars

TABLE II

RATE OF MANDIBULAR SPACE CLOSURE *

	Rate of anterior retraction (measured at the cuspid)			Rate of molar movement		
Patient	Stage I	Stage II	Comb.	Stage I	Stage II	Comb.
1	1.6**	.4	1.0	.4	.5	.5
2	.01	.3	.2	.6	.2	.4
3	-.2	.5	.2	.8	.8	.8
4	1.7	-.9	.4	.1	-1.0	-.5
5	1.0	.3	.7	.1	.2	.2
6	-.5	.5	.00	.5	.3	.4
7	.5	.6	.6	.03	.4	.2
Mean	.6 ±.1	.2 ±.1	.4 ±.1	.4 ±.2	.2 ±.2	.3±.2

* Measurements in mm. per month
**A positive measurement indicates distal movement of anteriors and mesial movement of molars. A negative measurement indicates mesial movement of anteriors and distal movement of molars

TABLE III

COMBINED RATE OF MAXILLARY AND MANDIBULAR SPACE CLOSURE *

	Rate of anterior retraction (measured at the cuspid)			Rate of molar movement		
Patient	Stage I	Stage II	Comb.	Stage I	Stage II	Comb.
1	1.2**	.4	.8	.4	.4	.4
2	.2	.2	.2	.7	.3	.5
3	.2	.1	.2	.5	1.1	.8
4	1.4	1.6	1.5	.2	-1.4	-.6
5	.5	.3	.4	.3	.2	.3
6	-.1	.4	.3	.3	.2	.3
7	.5	.4	.5	-.05	.6	.3
Mean	.6±.1	.5±.2	.6±.1	.3±.1	.2±.3	.3±.2

* Measurements in mm. per month

**A positive measurement indicates distal movement of anteriors and mesial movement of molars. A negative measurement indicates mesial movement of anteriors and distal movement of molars

TABLE IV

RELATIONSHIP OF ANTERIOR RETRACTION AND MOLAR MOVEMENT

IN STAGE I *

	$\frac{\text{Amount of anterior retraction}}{\text{Total space}} \times 100$			$\frac{\text{Amount of molar movement}}{\text{Total space}} \times 100$		
Patient	Mandible	Maxilla	Combined	Mandible	Maxilla	Combined
1	47**	47	46	15	9	13
2	4	24	16	57	52	54
3	-12	33	11	52	17	34
4	99	60	81	1	34	16
5	48	4	23	1	20	10
6	-1	2	1	12	-8	10
7	11	14	14	1	-1	1
Mean	28	26	27	20	18	20

* Measurements in percentages

**A positive measurement indicates distal movement of anteriors and mesial movement of molars. A negative measurement indicates mesial movement of anteriors and distal movement of molars

TABLE V

RELATIONSHIP OF ANTERIOR RETRACTION AND MOLAR MOVEMENT

IN STAGE II *

	Amount of anterior retraction / Total space x100			Amount of molar movement / Total space x100		
Patient	Mandible	Maxilla	Combined	Mandible	Maxilla	Combined
1	9**	19	17	24	25	24
2	21	3	10	18	21	20
3	21	-8	6	39	61	49
4	-12	25	16	12	-26	-7
5	31	50	40	19	34	26
6	62	31	48	27	59	41
7	51	28	40	33	58	45
Mean	26	21	25	25	33	28

* Measurements in percentages

**A positive measurement indicates distal movement of anteriors and mesial movement of molars. A negative measurement indicates mesial movement of anteriors and distal movement of molars

TABLE VI

RELATIONSHIP OF ANTERIOR RETRACTION AND MOLAR MOVEMENT

IN STAGE I AND II COMBINED *

	Amount of anterior retraction / Total space x100			Amount of molar movement / Total space x100		
Patient	Mandible	Maxilla	Combined	Mandible	Maxilla	Combined
1	61**	66	63	39	34	37
2	25	27	27	75	73	74
3	9	22	17	91	78	83
4	87	92	91	13	8	9
5	79	46	63	21	54	37
6	61	49	48	39	51	52
7	66	42	55	34	58	45
Mean	55	49	52	45	51	48

* Measurements in percentages

**A positive measurement indicates distal movement of anteriors and mesial movement of molars

TABLE VII

CEPHALOMETRIC VALUES

Criteria	Start of treatment Mean	End of Stage II Mean
ANB	4.5°±.9	5.5°±.8
FMA	26.0°±1.5	28.6°±2.3
FMIA	54.5°±2.0	58.0°±3.7
$\underline{1}$ - SN	105.5°±1.7	81.5°±1.5
$\overline{1}$ - AP	3.0 mm±.8	.5 mm±.9

TABLE VIII

MEAN INTERCUSPID SECOND BICUSPID ANGLES *

	Start of treatment	End of Stage II
Maxilla	1.5**	-21.4
Mandible	-4.0	-25.5
Mean	2.8	-23.5

* Measurements in degrees

**A positive measurement indicates converging roots and a negative measurement indicates diverging roots of cuspid and second bicuspid

TABLE IX

INCREASE IN SKELETAL HEIGHT *

Patient	Start of treatment	End of Stage II	Difference
1	55.5	56.0	.5
2	53.25	53.25	0.0
3	61.0	62.5	1.5
4	65.5	65.5	0.0
5	55.5	57.75	2.25
6	60.5	61.0	.5
7	64.5	64.75	.25
Mean	59.4	60.1	.7

* Measurements in inches

TABLE X

INCREASE IN SN LENGTH *

Patient	Start of treatment	End of Stage II	Difference
1	73.5	75.0	1.5
2	70.0	70.0	0.0
3	75.0	77.0	2.0
4	74.5	75.5	1.0
5	75.0	76.0	1.0
6	71.5	72.5	2.0
7	67.0	67.5	.5
Mean	72.3	73.4	1.1

* Measurements in mm.

CHAPTER IV

DISCUSSION

The selection of patients for this study was conducted to produce a homogenious group with as little internal variation as possible with the exception of sex. There were three boys and four girls selected. Ages ranged from 10.2 to 13.1. All cases had Class I molar relationship with the first molars in good occlusion, thus avoiding the variability inherent in correcting the molar relationship. All cases selected were bimaxillary protrusive requiring the extraction of four first bicuspids, and were classified as moderate anchorage cases. No cases had extreme mandibular plane angles or open or closed bites. None of the cases had anterior or posterior cross bites. All cases had complete permanent dentitions and all teeth were bandable. All patients and their parents agreed to cooperate with the research protocol. Thus, the primary variables in this study were the retraction of the anterior teeth and the resultant anchorage loss.

Each patient was assigned to one of the graduate students of the Orthodontic Department at the Loma Linda University School of Dentistry. By doing so the results would be less biased by individual operator skills.

In order to establish a point of reference from which to measure all patients were tattooed at the arbitrary hinge axis. This point was chosen because of its easy access and its stability. Being located

superficially over the base of the skull it was felt that it would be affected little by growth. Measurements were made from the hinge axis tattos to dimples placed on the labial surfaces of cuspids and molars. To avoid occlusal interferences during measurements, the cuspid dimples were placed gingival to the arch wire in the mandibular arch and incisally to the arch wire in the maxillary arch. The molar dimples were all placed just gingival to the buccal tubes. To further eliminate occlusal interferences and to allow the mandible to be placed in its terminal position, two cellulose pads were placed between the teeth at the time measurements were made. The extraction space was double checked by measurements made from one-to-one maxillary and mandibular occlusal photographs. It was found that as the cuspids tipped back that the maxillary dimple, being incisal to the arch wire, moved an exaggerated rate, while the mandibular dimple, being below the arch showed little movement and in some cases the dimple moved forward as the cusp moved back. It was also found that rotation of the cuspid gave extranious results. Because of the variances in the cuspid to tattoo measurement it was dropped in favor of the one-to-one photographs to determine space closure. Because of the location of the dimple on the molar, the measurement from ear to molar was reliable and it was kept as the index of molar movement, and is indicative of anchorage loss. Anterior retraction was determined by subtracting the amount of anchorage loss from the amount of space closure as determined from the one-to-one photographs. To reduce measurement errors all measurements were taken three times and the mean used in computations.

The occlusal camera used to take the one-to-one photographs was tested for distortion by taking photographs of a grid of known dimensions. It was found that there was no error in an anterior posterior direction. There was a four percent over all error in cross arch measurements. Since all measurements were taken in an anterior posterior direction the use of the camera was acceptable.

All cases were treated using the "pure" Begg "light wire technique" as outlined by Begg[5, 6] and taught by the Kesling and Rocke Orthodontic Center. The clinical supervision of the cases was directed by Dr. Peter C. Kao of Garden Grove, California. At no time were there any deviations from the prescribed treatment. To further standardize treatment an indirect banding procedure was used and appliances were made by T. P. Laboratories. All cases were checked by Dr. Kao at each appointment and adjustments made under his supervision.

The rates of maxillary and mandibular space closure as given in Tables I through III indicate that the rates of cuspid and molar movement are greater during Stage I than for Stage II at a rate of .6 to .5 mm. per month for anterior retraction and .3 to .2 mm. per month for anchorage loss. The over all rate of anterior retraction was twice that of anchorage loss at a rate of .6 to .3 mm. per month. The two negative rates of mandibular anterior retraction during Stage I were for patients where a multiple looped arch wire was used for unraveling crowded anteriors and represents "round tripping" of these teeth. Negative values of rate of anterior retraction during Stage II represents relapse due to lack of patient cooperation in wearing elastics during a portion of this treatment period. There was one case of a negative anchorage loss during Stage II. In this case all

spaces were closed early in Stage II and the negative molar movement can be explained by in-mass distal movement of the maxillary complex during this treatment period.

In Stage I, 28 percent of the mandibular space closure was attributed to anterior retraction and 20 percent to anchorage loss. The 18 percent anchorage loss in the maxilla during this period is difficult to explain because there was no mesial force applied to the maxillary molars, in fact the tip back bends would be expected to produce a distal force. A possible explanation is what Begg[6] calls the inherent movement of all teeth in a mesial direction. This could be accelerated at this age by continued erruption of second molars and the development of third molars. In Stage II 26 percent of the mandibular space closure was due to anterior retraction, while 25 percent was due to anchorage loss. 21 percent of the maxillary space closure in Stage II was due to anterior retraction, and 33 percent due to anchorage loss. The over all space closure for Stage I and II was divided as follows: Mandibular anterior retraction 55 percent, mandibular anchorage loss 45 percent, maxillary anterior retraction 49 percent, maxillary anchorage loss 51 percent. The over all anterior retraction for mandible and maxilla was 52 percent and anchorage loss was 48 percent.

Cephalometric values for the beginning of treatment and the end of Stage II as given in Table VII shows an increase in ANB from 4.5 to 5.5 degrees. It is difficult to explain any increase in ANB when patients were wearing Class II elastics through out treatment. A difference of one degree is within the range of measurement error. The FMA angle increased from 26 to 28.6 degrees. As the mandible

hinges open, B point moves back which can also explain the increase in ANB. At best all that can be said is that no appreciable change was made in the anterior posterior skeletal relationship. FMIA increased from 54.5 to 58.0 degrees. This is a result of the distal tipping of the lower incisors. The measurement $\underline{1}$ to SN decreased from 105.5 to 81.5 degrees. This is a result of distal tipping of the maxillary incisors. $\overline{1}$ to AP decreased from 3 mm. to .5 mm. All cephalometric values with the exception of ANB are those expected at the end of Stage II as described by Williams.[6]

The intercuspid second bicuspid angles as given in Table VIII were determined from periapical radiographs taken at the beginning of treatment and at the end of Stage II. The mean maxillary angle decreased from 9.5 to -21.5 degrees, and the mandibular angle decreased from -4.0 to -25.5 degrees. The mean for both arches decreased from 2.8 to -23.5 degrees. These results are expected for this technique at the end of Stage II.

There were two indexes of growth used. The first increase in skeletal height as given in Table IX, and the second increase in SN length as given in Table X. The mean height for the group at the beginning of treatment was 59.4 inches and the mean height at the end of Stage II was 60.1 inches. The significance of the difference between the means was tested by use of the "t" test and found not to be significant at the .05 level of confidence. The mean SN length at the beginning of treatment was 72.3 mm., and at the end of treatment was 73.4 mm. The significance of the difference between these means were also tested by use of the "t" test and found not to be significant at the .05 level of confidence. These results indicate that no statis-

tically significant growth occurred in these dimensions, and since these dimensions have been correlated to facial and mandibular growth, it may be assumed that no significant growth has occurred in these dimensions either.

The results of the patient discomfort scale gave a mean of 1.0± .2. The mean length of discomfort was 2± 1 days. This indicates that the patients felt little discomfort during treatment with the Begg technique. The scale of operator difficulty gave a mean of 1.4, showing that the students did not find the technique difficult to use. As with any subjective scale these criteria will only take on true meaning when compared with other techniques studied under like conditions.

The reported mean length of appointment time of 45 min. is not a true index of working chair time. Part of each appointment was taken by consultation with Dr. Kao while additional time was taken by filling out research data sheets. Again these data will only take on true meaning when compared with other techniques.

The length of treatment for Stage I and II is reported to be approximately 50 percent of the total treatment time.[6] The results of this study showed the mean treatment time for Stage I and II to be 7.7 months. Projection of mean total treatment time would be approximately 15.5 months which is favorable.

The results of this study support Begg's[4] contention that light forces -- 2 1/2 to 3 ounces -- will tip teeth. However, it does not support his statement that these forces will leave the anchor teeth almost stationary. Faustin[11] and Grafton[14] found anchorage loss in Begg treated Class I extraction cases to be 48 percent in the maxillary

arch and 51 percent in the mandibular arch. This study showed anchorage loss for Stage I and II to be 51 percent for the maxilla and 45 percent for the mandible. Strang[34] has stated that third stage anchorage control is the weak link in the Begg technique. If this is so we could expect our total treatment anchorage loss to be considerably greater than that found by Faustim and Grafton. The lack of root resorption reported in this study supports the findings of Gaudet.[13] However, a true comparison of the data can only be done after treatment is completed. The cephalometric data fits the expected values for the end of Stage II as described by Williams.[6] Further comparisons with other studies will have to wait until the completion of treatment. The results to date showing little patient discomfort agree with the findings of Brandt[8] and Sims,[32] but again no conclusive statements can be made until treatment is completed. Comparisons of treatment time with earlier studies can not be made because no specific data has been published -- only relative comparisons of techniques have been published.

A problem with most studies appearing in orthodontic literature is one of inadequate sample size. This study is no exception. Because the study was limited to seven patients the statistical variance of the measurements was large and the resulting statistical reliability of the data is in question. However, much was learned from this study, including clinical study techniques which can be applied to future large scale studies. Problems such as location of the measurement dimple on the cuspid can be avoided and techniques devised to eliminate the effect of growth on measurements.

The Begg technique has the advantage of seeing patients on a six week interval. There are few arch wire changes and the operators

found the mechanics of the first two stages relatively easy to work with. The patients experienced little discomfort during treatment. The major problem with the technique appears to be anchorage control. Also a great deal of the success of the Begg technique is dependent upon good patient cooperation.

CHAPTER V

SUMMARY

A comprehensive clinical evaluation of the Begg technique was conducted through the termination of Stage II mechanics. The results were compared with other clinical studies of the Begg technique appearing in the literature.

The study indicated that light forces in the range of 2.5 to 3 ounces are adequate for tipping teeth and closing extraction spaces. The effectiveness of the technique in maintaining anchorage is questionable. The cephalometric results were the expected at the end of Stage II. Patients experienced relatively little discomfort, and no root resorption was found. Clinicians participating in the study found the technique easy to work with. The length of treatment time for Stage I and II, and the projection of total treatment time was favorable.

REFERENCES

REFERENCES

1. Allen, James: "Changes in Vertical Relationships of Teeth During and Following Use of the Begg Light Wire Differential", Am. J. of Ortho., 54: 152, 1968.

2. Andreason, G. and Johnson, P.: "Experimental Findings on Tooth Movements Under Two Conditions of Applied Force", Angle Ortho., 37: 9, 1967.

3. Armento, R. J.: "A Comparative Radiographic Study of Certain Tooth Movements Observed in Treatment of 30 Deep Overbite Cases with the Begg Technique and 30 Deep Overbite Cases with the Bull Technique", Master's Thesis, Fairleigh Dickinson U. Sch. of Dent., 1965.

4. Begg, P. R.: "Differential Force in Orthodontic Treatment", Am. J. of Ortho., 42: 481-510, 1956.

5. Begg, P. R.: "Light Arch Wire Technique", Am. J. of Ortho., 47: 30-48, 1961.

6. Begg, P. R. and Kessling, P. C.: Begg Orthodontic Theory and Technique, W. B. Saunders Co., Philadelphia, 1971.

7. Booy, C.: "Difficulties and Failures Experienced with the Begg Technique", Europ. Orthodont. Soc. Rep. Cong., 95-108, 1967.

8. Brandt, Sidney: "Experiences with the Begg Technique", Angle Ortho., 32: 150-166, 1962.

9. Demoge, P. H.: "Symposium on Multibanded Appliances II Report on the Light Wire Technique", Dent. Pract. (Bristol), 16: 220-5, 1966.

10. Dimond, H. D.: "Practical Application of the Light Wire Technique", Am. J. Ortho., 48, 1962.

11. Faustin, N.: "Clinical Investigations Related to Use of the Begg Technique at the University of Tennessee", Am. J. of Ortho., 59: 24-36, 1971.

12. Fisher, R. S.: "A Cephalometric Comparison of the Results of Light-wire and Edgewise Mechanics in Extraction Treatment", Master's Thesis, St. Louis University, Sch. of Dent., 1964.

13. Gaudet, Elmer L.: "Tissue Changes in the Monkey Following Root Torque with the Begg Technique", Am. J. of Ortho., 54: 934-5, 1968.

14. Grafton, G.: "Evaluation of Anchorage in Class I and Class II, Division 1 Malocclusions Treated with Begg Light Wire Differential Force Technique", Am. J. of Ortho., 54: 74-75, 1968.

15. Guido, M. G.: "An Evaluation of the Effect of Class II Traction on the Maxillary Complex Under Begg Appliance Therapy", Master's Thesis, Fairleigh Dickinson U. Sch. of Dent., 1964.

16. Hixon, E. H., Aasen, T. O., Arango, J., Clark, R. A., Klosterman, R., Miller, S. S., and Odom, W. M.: "On Force and Toothe Movement", Am. J. of Ortho., 57: 5, 1970.

17. Hixon, E. G., Atikian, H., Callow, C. E., McDonald, H. W., and Tracy, R. J.: "Optimal Force, Differential Force and Anchorage", Am. J. of Ortho., 55: 437-457, 1969.

18. Jarabak, J. R. and Frizzell, J. A.: Technique and Treatment with the Light-Wire Appliance, The C. V. Mosby Co., St. Louis, 1963.

19. Kesling, P. C.: "Causes of Loss of Anchorage in First and Second Stages", Begg J. Ortho. Theory and Treat., 2: 23-30, 1963.

20. Kottraba, T. M.: "The Begg Light-Wire Treatment: A Comparative Study", Am. J. of Ortho., 59: 386-401, 1971.

21. Leno, N. M.: "A Radiographic Cephalometric Analysis of the Movements of Molars and Incisors in the First Stage of the Begg Technique", Master's Thesis, Fairleigh Dickenson U. Sch. of Dent., 1965.

22. McDowell, C. S.: "The Hidden Force", Angle Ortho., 37: 109-131, 1967.

23. Newman, G. V.: "A Biomechanical Analysis of the Begg Light Arch Wire Technique", Am. J. of Ortho., 49: 721-740, 1963.

24. Oppenheim, A.: "A Possibility for Physiologic Orthodontic Movement", Am. J. Ortho. and Oral Surg., 30: 277-327, 345-368, 1944.

25. Orban, B.: "Biologic Problems in Orthodontia", J. of Am. Dent. A., 23: 1845-1855, 1936.

26. Parker, C. D.: "Bodily Retraction of Upper Incisor Teeth Using a Modified Begg Arch", Brit. Soc. Study Ortho. Tr., 87-94, 1963.

27. Parker, W. S.: "A Consideration of the Pure Begg Technique", Angle Ortho., 39: 1-10, 1969.

28. Perlow, J.: "A Critique of the Begg Technique from the Standpoint of Biomechanics", Am. J. of Ortho., 54: 407-432, 1968.

29. Phillips, J. B.: "Effect of Intermaxillary Traction on the Occlusal Plane in Malocclusion Treated by the Begg Technique", Am. J. of Ortho., 52: 858, 1966.

30. Rocke, R. A.: "Management of Overbite Within the Vertical Dimension", Begg J. of Ortho. Theory and Treat., 3: 9-18, 1964.

31. Schwarz, A. M.: "Tissue Changes Incidental to Orthodontic Tooth Movement", Int. J. Ortho., 18: 331-352, 1932.

32. Sims, M. R.: "Begg Philosophy and Fundamental Principles", Am. J. Ortho., 50: 15-24, 1964.

33. Storey, E. and Smith, R.: "Force in Orthodontics and Its Relation to Tooth Movement", Australian J. of Dent., 56-11, 1952.

34. Strang, R. H. W.: "Discussion of the Newer Trends and Techniques", Angle Ortho., 31: 184-188, 1961.

35. Utley, R. K.: "The Activity of Alvolar Bone Incident to Orthodontic Tooth Movement as Studied by Oxytetracyclin Induced Fluorescence", Am. J. Ortho., 54: 167, 1968.

36. Van der Heydt, K.: "Can the Challenge of Modern Orthodontic Standards Be Met with the Begg Technique", Am. J. Ortho., 51: 321-341, 1965.

LOMA LINDA UNIVERSITY

Graduate School

A CLINICAL EVALUATION OF SPACE CLOSURE AND ANCHORAGE LOSS IN STAGE I AND II BEGG TREATMENT

by

William G. Byrne

•

An Abstract of a Thesis

in Partial Fulfillment of the Requirements

for the Degree of Master of Science

in the Field of Orthodontics

May 1972

ABSTRACT

There has been much controversy about the Begg technique since its introduction in this country. This controversy has focused on the biomechanics, specific tissue reactions, the speed, ease, chair time, and patient comfort experienced in its use, and the cephalometric results of treatment. Because of the magnitude of the discrepancies found in the literature, a comprehensive clinical evaluation of the Begg technique was conducted through the termination of Stage II mechanics.

The study indicated that light forces in the range of 2.5 to 3 ounces are adequate for tipping teeth and closing extraction spaces. The effectiveness of the technique in maintaining anchorage is questionable. The cephalometric results were the expected at the end of Stage II. Patients experienced relatively little discomfort, and no root resorption was found. Clinicians participating in the study found the technique easy to work with. The length of treatment time for Stage I and II, and the projection of total treatment time was favorable.