A Cephalometric Comparison of Cases Treated with Edgewise and Begg Techniques

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INTRODUCTION

Orthodontists will always be in quest of the perfect technique; a technique that requires minimal patient cooperation, will produce a well-balanced occlusion, and reduce the A-B plane to an ideal relationship without adverse effects to the occlusal and mandibular planes.

Much has been written in the last fifteen years on the mechanics of the Begg philosophy and many men are of the opinion that this technique fulfills their goals of an ideal appliance. The author has been intrigued with this technique and therefore has undertaken this project in order to gain some insight of the Begg appliance and compare the cephalometric changes with edgewise cases treated with a cervical Kloehn headgear.

REVIEW OF LITERATURE

The Begg philosophy was first introduced in 1954 when Begg described Stone Age Man's attrition. From his studies of the aborigine he concluded that the third molar migrated forward approximately half an inch between teen age and the time of its eruption. This migration was accomplished by the attrition of the contact areas and the occlusal surfaces. Begg observed a very healthy condition of the gingiva in the aborigine and suggested that we resort to an artificial compensation of attrition by eliminating the four first premolars in conjunction with orthodontic treatment.

Begg introduced the term "differential force" and described it as the ability to put bodily moving forces against tipping moving forces. His theory was based primarily on Storey and Smith's research in which they reported that force values of six ounces produced physiologic tipping movements in single rooted anterior teeth and yet had little effect on bodily movement or multirooted posterior teeth. They reported that a force of twelve ounces or more would be necessary in order to cause a bodily movement of the posterior teeth.

Kesling, Williams, Von der Heydt, Perlow, Parker, McDowell, Sims, Barrer, Newman and others have written further on the subject of the Begg philosophy. They agree with the theory of differential force as a force great enough to move some teeth but not enough to move others.

OPTIMAL FORCES

The theory of optimal forces comparing light continuous forces and heavier intermittent forces has long been a question mark to orthodontists. The early investigators of tissue reaction to orthodontic forces were Sandstedt, Schwarz and Oppenheim. Sandstedt pointed out that alveolar bone is resorbed on the pressure side and new bone is laid down on the tension side. Schwarz maintained that heavier forces produced an area of hyalinization on the pressure side and delayed tooth movement. He maintained that the most favorable force for tooth movement was 25 grams /CM^2. Both Schwarz and Oppenheim concluded that a light continuous force was more desirable.

Later, the studies of Gottlieb, Orban,

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Sicher, Reitan, Wentz and associates laid the framework of our basic understanding of histologic changes. They found that lighter forces produce surface resorptions by osteoclastic activity on the pressure side and osteoblastic activity on the tension area forming osteoid tissue and then new bone.

In 1952 Storey and Smith reported that a force of 200 grams or less would move the cuspids with a negligible effect on the molar teeth, but a greater force of 500 grams caused the molars to move forward while the cuspids remained stationary.

Reitan's research on tissue changes was very significant. He was in favor of light continuous forces but was of the opinion that more hyalinization and tissue damage was apt to occur in tipping of teeth in the alveolar ridge area, indicating that bodily light moving forces would cause less tissue damage. He concluded that there was less hyalinization in bodily movement than tipping movements with an equal force. Reitan further stated that two to three weeks were required to eliminate an hyalinized area. Therefore, he favored an initial light force until the hyalinization had disappeared and then the force could be increased. He suggested that a force exceeding 200 grams would produce hyalinization.

Orban also favored a light continuous force and agreed that the osteoid tissue area of hyalinization was the initial response to forces. He showed this area to be acellular and immune to resorption.

Jarabak favored light continuous forces and described light forces as one to four ounces and intermediate forces as five to six. He felt that forces beyond six ounces were excessive for a normal cellular response in bone.

One would conclude from the findings of these men that a light continuous force is more advantageous in moving teeth and that the magnitude of the force should be such as to compress the periodontal fibers and yet minimize the amount of hyalinization in order that osteoclastic activity may begin.

McDowell agreed with the theory of differential force as he describes his theory of "static anchorage." He feels that maximum anchorage (static anchorage) may be accomplished by a combination of two forces, the force of occlusal contact and the force of the tense oblique fiber hammock.

Williams found that the mandibular plane steepened in Stages I and II of Begg technique but tended to return in Stage III and the retention period.

The followers of Begg are of the opinion that the differential force appliance will cause less tissue damage. Two men have made comparisons of tissue damage from different techniques and forces. Baxter concluded that there was no significant difference in the change of the height of the alveolar bone to the cemento-enamel junction between extraction and non-extraction cases, and between Begg and edgewise cases. Tirk reported that he did not have enough material to make a statistical appraisal of the effect of orthodontic mechanisms on various types of dentitions, but he did note unfavorable reactions of the investing tissues that occurred more frequently than he had previously suspected.

Recently, Utley, Higley, Hixon, Andreasen and Johnson have questioned the theories of optimal and differential forces.

Utley experimented with cats using three different forces of 40-60 grams, 135-165 grams and 400-560 grams. He found that, regardless of the force, the cuspids and molars moved approximately the same amounts.

Andreasen and Johnson experimented with headgears and found that a force

of 400 grams moved a molar tooth of the same patient two and a half time farther than a force of 200 grams.

Hixon showed that higher forces caused more rapid movement than lighter forces and noted that molars moved less when the brackets were angulated or a tip-back bend incorporated in the archwire. He concluded that the variation between patients precluded formulation of theories regarding force and anchorage. These variations between patients included root area, age of patient, and density of the bone.

Higley discussed the theory of differential force and felt that, if molars will drift forward as explained in Stone-age Man's attrition, surely a force of sixty to seventy grams would also influence the mesial migration of those teeth.

Headgear Therapy

The use of extraoral forces was first reported in the 1800's by Cellien who developed cervical and occipital traction for luxation of the mandible. Later, in the nineteenth century Kingsley and Angle advocated an occipital headgear to aid in retraction of anterior teeth. Oppenheim rejuvenated the use of headgear therapy in 1936 and then, in 1947, Kloehn reported on an occipital headgear that attached to the archwire. He later modified the appliance by soldering the outer and inner bow creating the now popular facebow.

Silverstein in 1954 was the first to recognize rotation of the mandible and since, Schudy, Poulton, Tweed, Burstone, Ricketts and Weislander have studied the effects of headgear therapy.

Schudy made us aware of the vertical components of force and their effects on the forward positioning of pogonion. He suggested that we plan our mechanics to minimize molar extrusion in all but low mandibular plane angle cases. He felt we should strive to intrude the maxillary incisors in higher mandibular plane and thus allow the mandible to position itself in a more forward position. He stated that Class II elastics elevate mandibular molars causing the occlusal plane and mandibular planes to steepen thus dropping point B and pogonion downward and backward; however, they are desirable in low angle cases. We should not intrude lower incisors as they tend to return and close the bite.

Poulton has been quite conscious of molar extrusion as he recommended an occiptal type headgear. He suggested that the pull be through the center of resistance (mass) of the maxilla thus allowing a more forward positioning of pogonion.

Weislander showed evidence that headgear therapy affected areas outside the dento-alveolar area.

From an analysis of forces used in Class II treatment, Bien concludes that the headgear has fewer undesirable qualities than intermaxillary elastics as far as treatment results are concerned.

Many orthodontists have come to regard Begg's concept of attritional occlusion and the inherent tendency to mesial migration as a normal physiologic phenomenon with significant implications regarding the need for extractions in orthodontic treatment. In addition, many agree with his thesis that the use of headgear in orthodontics is contraindicated because it arrests normal mesial migration of teeth and thus merely defers future collapse due to the reappearance of mesial migration following removal of the appliances.

Comparison of Headgear and Class II Elastics

Several studies comparing cases treated with edgewise plus headgear and the Begg technique are reported in the literature. Parker, Ricketts, Haw

and Fischer have studied the differences of Begg and edgewise cases treated with a cervical headgear. Conclusions were drawn from these studies but they may be questionable because of the discrepancies in the samples.

Ricketts generalized that the Begg treatment produced a greater opening of the Y axis, tipped the occlusal plane, extruded the lower first molar, and exhibited less reduction of point A.

Haw analyzed forty-four cases of Parker's treated with the Begg appliance and concluded that the Begg appliance tipped the occlusal plane and failed to torque the upper incisors sufficiently. Surprisingly, the mandibular plane was not altered as one might suspect.

Fischer studied eleven cases treated with the Begg appliance and eleven cases treated with the conventional Tweed mechanics. He felt that the Tweed mechanics improved the ANB relationship and maintained a more favorable mandibular and occlusal plane. The Begg appliance lost more anchorage and failed to torque the upper incisors adequately.

Methods and Materials

This study involved the cephalometric comparison of eighteen cases treated with the pure Begg technique and eighteen cases treated with the edgewise appliance in conjunction with a Kloehn-type cervical headgear. All cases were treated with the extraction of the four first premolars.

The edgewise sample was derived from my practice and the Begg cases were taken from the practice of Dr. William Thompson of Florida.

The samples were compared according to age, sex and corresponding mandibular plane angles. Table I shows the range and means of the sample before treatment:

Table I

	Edgewise	
	Range	Mean
Age	11.3-15.4	12.8
NSMP	28-43	35.22
ANB	2-9	5.58

Begg	
Range	Mean
11.1-15.5	13.06
28-42	34.63
2-9	4.88

Different cephalometers were obviously used for each sample so the differences of the measurements were compared in order to minimize any discrepancies. The target film distance was similar in both techniques.

Treatment with the edgewise technique consisted of a full banded appliance with the .022 bracket. Space closing was accomplished with coils and Bull loops in conjunction with a Kloehn-type cervical headgear to the maxillary first molars. The outer bow of the headgear was parallel with the molars and the outer tip was located approximately one inch posterior to the molar. An elastic force of 12-16 ounces was applied to the headgear and only patients whose cooperation was above average were accepted for the study. A few cases had up-and-down elastics for final cusp seating but no Class II elastics were used. The Begg sample was treated with the classic Begg as described in the literature with an elastic force of 2-4 ounces of pull.

Seven angular measurements and ten linear measurements were studied. The means and mean differences were computed and the differences compared with the "t" test (Table II).

Discussion

This discussion will be based on the cephalometric differences of the before and after tracings of all thirty-six cases (Table II). The discussion will be

TABLE II

	Headgear			Begg			
	Before	After	Diff.	Before	After	Diff.	"t"
SNA°	82.08	79.06	—3.02	82.00	79.25	—2.75	.45
SNB	76.28	76.36	+ .08	77.19	76.25	— .94	1.96
ANB	5.80	2.70	—3.10	4.81	3.00	—1.81	2.21*
SNMP	35.22	35.97	+ .75	34.64	36.03	+1.39	.89
SNPP	6.14	6.86	+ .72	7.00	8.25	+1.25	1.32
SNOP	16.61	16.80	+ .19	14.97	18.56	+3.59	3.32**
NME (mm)	113.8	121.75	+7.95	114.86	120.17	+5.31	1.87
U6 ↓			+1.81			+ .69	3.30**
U6 →			+3.10			+4.00	2.07
L6 ↑			+2.00			+2.30	.53
L6 →			+2.56			+3.31	1.51
$\underline{1}$ NA°	23.89	23.50	— .39	24.39	19.06	—5.33	2.05
U1 ↓ (mm)			+ .53			+1.25	1.31
U1 ←			+5.44			+5.00	.62
$\overline{1}$ APO (mm)	3.06	1.50	—1.56	3.00	1.56	—1.44	.33
L1 ↑			+ .61			— .03	1.15
L1 ←			+3.61			+2.72	1.41

* Significant at 5%
** Significant at 1%

categorized in the following groups:

Apical Base Relationships (SNA, SNB, ANB)

Vectorial Growth Patterns (SNMP, SNOP, SNPP)

Vertical Height (NMe U6 U6 L6 L6)

Maxillary Incisors $\underline{1}$ NA U1 U1

Mandibular Incisors $\overline{1}$ APO L1 L1

Apical Base

The mean difference of the before and after measurements of SNA was —3.02 degrees for the headgear and —2.75 degrees for the Begg cases. These differences are very similar and compare favorably with those of other studies. Fischer showed a reduction of 1.87 degrees with his headgear cases and 1.57 degrees with the Begg. Hanes showed a reduction of 2.4 degrees and 2.5 degrees with his treatments comparing edgewise with headgear and edgewise with Class II elastics.

The difference of SNB was + .08 degrees for the headgear and —.94 degrees for the Begg. The ANB differences were —2.72 degrees for the headgear and —1.88 for the Begg. These measurements indicate that Point A was retracted sufficiently by both techniques; however, point B tended to move lingually with the Begg technique.

Vectorial Growth Patterns

The measurements SNMP, SNOP and SNPP increased in both treatments. The occlusal plane opened 3.59 degrees with the Begg but only 0.19 de-

grees from the headgear. The palatal and mandibular planes opened slightly more by the Begg appliance but only the occlusal plane showed a significant difference.

Vertical Height

As one would suspect, these measurements showed more extrusion of the upper molar with the edgewise mechanics than Begg. The mesial movement of the upper molar was greater in the Begg than the edgewise. However, the lower molar extruded approximately the same from both mechanics. This finding was contrary to those of Ricketts and Fischer who showed significant differences in the elevation of the lower molar. Williams and Thompson have shown that the lower molar extrudes in Stage I of the Begg, but by Stage III or retention, the first and second molars are similar in height. They claim that the freeway has been encroached upon preventing further extrusion, and then growth encourages eruption of the other teeth. This similarity of the elevation of the lower molars from both treatments is interesting. I can't help but feel that we must become more aware of the freeway space and its relationship to vertical development and the theories of extrusion and intrusion of teeth.

The measurement of NMe showed a greater opening in the edgewise than the Begg. The NMe dropped 7.95 millimeters from the headgear and 5.31 millimeters from the Begg. This confirms the previous explanation that the total extrusion of upper and lower molars is greater from headgear therapy.

Maxillary Incisors

The maxillary incisors were retracted a similar amount by both techniques but the edgewise exhibited greater torquing action. The upper incisors were 23.50 degrees to NA after treatment from the edgewise and 19.06 degrees from the Begg. These findings are similar to those of Fischer and Ricketts; had the maxillary incisors been torqued to a more desired position, more anchorage loss would have been evident.

Mandibular Incisors

The measurements comparing the movements of the lower incisor were very similar in both appliances. The lower incisor was retracted 3.61 millimeters with the edgewise and 2.72 millimeters by the Begg indicating that both treatments resulted in a favorable retraction of the lower incisor. There is a slight difference in the vertical position as the lower incisor tended to intrude more from the Begg treatment than the edgewise.

In general, all the findings were as one might suspect except that the lower molar elevated the same in both techniques. Some up-and-down elastics were used in the edgewise sample but no Class II elastics were employed. Also, the mandibular second molars were banded in all the edgewise cases which may or may not have had some influence on the extrusion of the first molars. Then too, it may tend to show that in Stages II and III of Begg, the lower molars do level out.

From these findings I tend to conclude that the headgear treatment dropped the mandible straight down whereas the Begg technique caused a slight rotation of the mandible. This explanation is similar to that of Thompson and Williams but they have found that their occlusal and mandibular planes return to the original position during retention.

Actually we orthodontists are mainly concerned with our results years after treatment. These comparisons are only the beginning of a study. They should be compared many years later. I'm only venturing an opinion, but I suspect that both of these treatments will compare very favorably ten years out

of treatment except for perhaps the inclination of the upper incisors which might affect the overbite.

Summary and Conclusion

This study involved the cephalometric comparison of eighteen cases treated with the pure Begg technique and eighteen cases treated with the edgewise appliance in conjunction with a cervical Kloehn headgear.

The mean differences of seven angular and ten linear measurements were calculated and compared with the "t" test.

1. SNA was reduced a similar amount in both techniques.
2. SNB decreased more with the Begg technique which was also reflected in the ANB.
3. The mandibular and palatal planes were opened a slight amount from both treatments; however, the occlusal plane showed a greater opening by the Begg technique.
4. The maxillary first molars were extruded more from the headgear technique.
5. The mandibular molars were extruded a similar amount.
6. The facial height increased during both treatments.
7. Anchorage loss was greater in the maxilla from Begg.
8. Both the maxillary and mandibular incisors were retracted similarly and there was no significant difference in their extrusion or intrusion.
9. The maxillary incisors were not torqued sufficiently by the Begg technique and, if they had been, more anchorage loss would have been evident.
10. Further studies comparing the various treatments years after treatment are indicated.

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