EFFECTS OF CLASS II TREATMENT ON THIRD MOLAR ANGULATION AND ANTERIOR PAR COMPONENT

By

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OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
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To my mom Karen for her continuing support.
To my cat Cricket for putting up with my absence.

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The purpose of this study was to follow the development of the 3rd molar with age, compare differences in 3rd molar angulation amongst headgear/biteplane, bionator, and observation groups; and to compare incisor PAR index to the 3rd molar angulation.

This study is a retrospective extension derived from a previous prospective, longitudinal, randomized clinical trial.

Angulations of the 3rd molars were measured at the end of Phase I (DC-3), post-Phase I (DC-5), baseline at Phase II (DC-7), end of Phase II (DC-F), one year into retention (DC-R1), and two years into retention (DC-R2). A total of 807 panoramic films were measured. Angulations of lower 3rd molars were compared at each time point among the three treatment groups using both Kruskal-Wallis and Analysis of Variance tests. Lower and upper anterior PAR indices were compared to the respective lower or upper 3rd molar angulation. Spearman correlation of coefficients was used for both the average 3rd molar angulation per arch and the most extreme 3rd molar angulation.

The lower 3rd molar's angulation did not differ significantly between treatment groups at time points DC-3, DC-5, DC-7, DC-F, DC-R1, or DC-R2. The lower anterior PAR index had a

mild positive correlation at DC-F with a mesial angulation of the lower 3rd molar. The highest significant correlation (r=0.18795, p= 0.0156) was found when the Spearman correlation of coeffiecients was used with the most extreme lower 3rd molar angulation. The bionator group was the only treatment group at DC-F which showed any correlation with 3rd molar angulation and PAR index. It revealed a mild correlation with anterior PAR index increasing with mesial angulation of lower 3rd molars (r=0.30659, p=0.303) and distal angulation of the upper 3rd molars (r=-0.33849, p=0.0141).

Neither bionator nor headgear/biteplane Phase I treatment appears to influence significantly upon the angulation of the developing 3rd molars. The only statistically significant correlation 3rd molar angulation had with anterior PAR component was found at the end of Phase II treatment, where clinical significance is most likely low since teeth should be aligned at this stage.

CHAPTER 1
INTRODUCTION

Third molars are first able to be seen on a panoramic radiograph as early as age 5 and as late as age 16 years.[1] Gravely,[2] Rantanen,[3] and Haavikko[4] reported that initiation of calcification is typically seen between 6 and 13 years of age, with the average age being between 9 to 10 years. The completion of the 3rd molar crown was reported at between 11 and 15 years of age. Normal eruption of teeth is expected between the ages of 18 and 24 years.[5, 6]

Rates for mandibular 3rd molar impaction range between 9.5% and 50%.[7, 8, 9, 10, 11] Dachi and Howell[12] found in a study examining 3874 routine panoramic films that 29.9% of maxillary third molars and 17.5% of mandibular 3rd molars were impacted when present. This study did not find any predilections towards sex or bilateral versus unilateral impaction. As the distance of the retromolar space increases, the likelihood of mandibular 3rd molar impaction decreases. For every millimeter increase in the width of the 3rd molar crown, there is a 44% increase in the risk of maxillary 3rd molar impaction.[13, 14]

Questions regarding extraction of other teeth in the arch influencing the eruptive potential of the 3rd molar have been studied. Richardson[15] found that extraction of a lower 2nd molar almost eliminates the occurrence of a mesioangular lower 3rd molar impaction. Bjork[7] noted that the loss of other teeth in the mandible may improve the chances of eruption of the lower 3rd molars. Further studies focused on the fate of 3rd molar impaction following a premolar extraction among orthodontic patients. Faubion[16] concluded that the prevalence of 3rd molar impaction is reduced but not eliminated in cases treated by extraction of premolars by as much as fourfold. Artun[17] found that the decision to extract premolars with orthodontic treatment in the maxilla reduces the risk of 3rd molar impaction by 76% due to the mesial movement of the maxillary molars. Kim[18] conducted a study looking at the 3rd molar impaction in orthodontic patients treated either non-extraction (n=105) or with the extraction (n=53) of four premolar teeth. Non-extraction patients showed higher scores of 3rd molar impaction, less mesial movement of the molars from before treatment to after treatment, and a smaller retromolar space in both arches compared to extraction patients. Staggers[19] study looked at first premolar extraction and found that, unlike the study on second premolar extraction, the 3rd molar angulation and eruption during and after orthodontic treatment was not significant between extraction versus non-extraction groups.

Angulation plays an important role in determining whether a 3rd molar is fated for impaction. Initially, many 3rd molars have a mesial inclination but progressively become more upright to the age of 25.[20, 6] Richardson's[21] five-year longitudinal study looking at 46 children on an annual basis found that the steeper the angle of the lower 3rd molar to the mandibular plane at age 10 years, the more likely it is to erupt within the next five years. By measuring the growth of the mandible and comparing the lower 3rd molars which uprighted, Richardson[21] found that the change in angulation seemed to be independent of mandibular growth. Bjork[7] disagrees and believes that the growth of the mandible is an important factor that contributes to making space for the 3rd molar.

A controversial subject regarding mandibular impacted 3rd molars is whether they increase the likelihood of lower anterior crowding of the dentition. A survey in 1971 taken by 600 orthodontists and 700 oral surgeons found that 65% were under the impression that 3rd molars sometimes produce crowding of the mandibular anterior teeth.[22] A survey from 2007 noted that more recent orthodontic graduates are less likely to recommend prophylactic removal of 3rd molars to prevent lower anterior crowding than their counterparts who graduated from residencies in the 1970s and 80s.[23] Many studies have looked at whether or not lower 3rd molars have an impact on anterior alignment. Longitudinal studies have compared subjects based on whether or not a lower 3rd molar was erupted, unerupted, or impacted. Other studies have merely noted the presence or absence of a lower 3rd molar. A handful of studies have prophylactically removed a lower 3rd molar on one side of the mandible and not on the other side to see if unilateral lower anterior crowding or mesialization of the teeth would occur. The conclusions seem to be split down the middle. Half the studies found that lower 3rd molars influenced lower anterior crowding,[24, 25, 26] while the other studies did not find a correlation.[27, 28, 29] Bergstrom[27] also looked at upper 3rd molars and found that they did not appear to have an influence on upper anterior crowding.

Early Class II treatment may have an effect on the uprighting of the 3rd molars during development. Studies[30, 31, 32] have looked into the anteroposterior skeletal and dental changes after early Class II treatment with headgear and bionator therapies. Dental effects have shown that headgear causes distal maxillary molar movement and that bionator treatment retracts maxillary incisors.[30] O'Brien's[31] study found that for a twin-block appliance used in early Class II treatment that the molar correction was found to be due to 41% skeletal versus 59% dental. Despite a predominant dentoalveolar change, mesial or distal displacement of the posterior dentition may influence the eruptive potential of the 3rd molar.

Keeling's[30] study looked at 325 subjects randomized to bionator, headgear/biteplane, or observation in an early Class II treatment. Significantly more skeletal Class II correction was found in the bionator and headgear groups compared to the observation group. The headgear group showed a more significant dental Class II correction in the maxillary molar and incisor position compared to the bionator. The headgear group also showed a significant molar relapse during the 6-month retention phase. This study also found enhanced mandibular growth in both the headgear and bionator groups. Turkkahraman and Sayin's[33] study looking at activator as well as activator headgear treatment found that both encouraged mandibular growth, lengthening the mandible by approximately 3 mm. This study agrees with Tulloch et al[34] that long-term benefit of achieving early greater growth compared to untreated subjects still remains to be confirmed. This early treatment may encourage the 3rd molar to develop in a more favorable position.

The purpose of this study was to evaluate the changes in angulation of the 3rd molar during its development, the influences bionator or headgear/biteplane treatment may have on the angulation of the developing 3rd molar, and if upper and lower anterior crowding PAR components are correlated to 3rd molar angulation.

CHAPTER 2
MATERIALS AND METHODS

Subjects

The subjects were part of a previous prospective, longitudinal, randomized clinical trial designed to examine and report the effectiveness of early treatment with bionator or with headgear/biteplane in patients with Class II malocclusion. Changes were compared over a similar time period to an observation control group. A stratified block randomization procedure was used to assign a treatment protocol during Phase-1 for each patient. Strata was defined by severity of Class II malocclusion, need for preparatory treatment, mandibular plane angle, race, and gender. After completing Phase-1, both treatment and control groups underwent fixed appliances in Phase-2, followed by a retention/follow-up period. The study design and subject selection are described in detail in the previous publication.[32]

Methods

Angulations were calculated on the panoramic film for both maxillary and mandibular 3rd molars exhibiting at least 1/3 crown calcification development at data collection (DC). Time points included the end of Phase I (DC-3), post-Phase I where the subjects were randomized for 6 months into retention or no retention, followed by all subjects with no retention for an additional 6 months (DC-5), baseline at Phase II (DC-7), end of Phase II (DC-F), one year into retention (DC-R1), and two years into retention (DC-R2). First and third molar templates were made from the best developed panoramic film for each patient in each quadrant. Two points on the occlusal surfaces of each molar were marked on the template. The templates were then overlayed on each panoramic film and the two points of the 1st and 3rd molar were marked in each quadrant. The crown of the 1st molar was used as a reference for the occlusal plane. The CalComp Drawing Board III digitizer® was use to measure an x and y axis on the occlusal table of each 1st and 3rd molar crown in order to calculate the angulation. Positive measurements indicate mesially inclined molars. One examiner collected all of the measurements. Intra-examiner reliability was tested by measuring fifteen panoramic films two weeks apart. Measurements were within 5 degrees at 95.89% of the calibration measurements. The upper and lower anterior PAR indices were taken from a previous study on the same subjects.[35]

Data Analysis

Relationships between angulation and treatment group were examined with Kruskall-Wallis and Analysis of Variance tests with a p-value less than 0.05 considered statistically significant. Spearman's Correlation of Coefficients was used to examine any relationship between 3rd molar angulation and anterior PAR indices.

CHAPTER 3
RESULTS

Time points DC-3, DC-5, DC-7, DC-F, DC-R1 and DC-R2 were chosen to analyze based on a sufficient number of panoramic films available to measure where 3rd molars had at least 1/3 of their crowns calcified. The sample consisted of 239 subjects in the Class II study, whose 3rd molar angulation was calculated at one or more of the time points under consideration. The Class II study randomly distributed 325 subjects into bionator, headgear/biteplane, and observation groups based on gender, race, severity of molar classification, pre-treatment, and retention post-phase I treatment. Since the 239 subjects analyzed in this study was a subpopulation of the larger study, analyses were performed to see if these variables were still well distributed. No bias was found among the distributions, with p-values well above 0.05 as shown in Table 3-1.

Table 3-2 shows the actual number and percentage of the 807 panoramic films analyzed at each time point. Table 3-2 also displays the mean age for the subjects at each time point, the total number of lower and upper 3rd molars measured, and data collection time points where 3rd molars had been extracted since the previous panoramic taken. A larger number of films were available at time points DC-7, DC-F, and DC-R1. Many 3rd molars did not have 1/3 of their crown calcified at the earlier time points (DC-3 and DC-5) and subjects were either lost to follow up or had their 3rd molars extracted by the later time point (DC-R2). Only 9 of the 239 subjects had their 3rd molars extracted. Ninety-three percent had all third 3rd developing, while 18 of the 239 subjects, or approximately 7.53%, were congenitally missing at least one 3rd molar.

Figure 3-1 depicts the mean angulation of the combined left and right lower 3rd molars per time point, regardless of their treatment or control group. The term uprighting will describe a 3rd molar that has a mesial angulation but less so than its original angulation. The lower 3rd molars in DC-3 were approximately 4 degrees more mesially angulated than the lower 3rd molars measured in DC-R2. Figure 3-2 reveals that the mean angulation of the upper 3rd molars at DC-3 were approximately 12 degrees more mesial than the upper 3rd molars measured in DC-R2. It should be noted that not all 3rd molars were measured at each time point analyzed.

The average angulation of the 3rd molars broken down into treatment/control groups is shown in Figure 3-3 and 3-4. No significance between angulation among treatment groups were found for any of the time points analyzed using both Kruskal Wallis and Analysis of Variance methods. The bionator group did not show a mean change in lower 3rd molar angulation from DC-3 through DC-F, but did show an uprighting of approximately 4 degrees two years into retention (41.21 to 36.61 degrees and 42.84 to 31.15 degrees respectively). The control group showed a 1 degree increase in mesial angulation between DC-3 and DC-F, with this angulation staying stable two years into retention. The headgear/biteplane group showed the largest uprighting effect with a 4 degree change between DC-3 and DC-F (42.84 to 38.99 degrees) and then an additional 7 degrees of uprighting two years into retention (31.15 degrees).

In regards to the upper 3rd molar both the bionator and control group had a few degrees of increased mesial angulation between DC-3 and DC-F, followed by a few degrees of uprighting which left them close to their original DC-3 angulation two years into retention. The headgear group displayed a mean 3 degrees of uprighting between DC-3 and DC-F (34.91 to 31.09 degrees), followed by an additional 2 degrees of uprighting two years into retention (29.29 degrees).

Mandibular and maxillary anterior crowding based on the PAR index was assessed from casts taken at the six DC time points analyzed. Spearman Correlation of Coefficients was used to determine if the angulation of the 3rd molar influenced the anterior crowding PAR component.

No significant correlation was found between the lower 3rd molar angulation and the lower anterior crowding PAR component at time points DC-3, DC-5, DC-7, DC-R1, and DC-R2. DC-F showed a p-value under 0.05 using Spearman Correlation of Coefficients finding a positive correlation value of 0.15544, as shown in Table 3-3. The mandibular anterior crowding PAR component was also evaluated based on the most severely (maximum) lower 3rd molar angulation, rather than the average of the two in the mandible. Again, no significant correlations were found at time points DC-3, DC-5, DC-7, DC-R1, and DC-R2. DC-F again showed a p-value under 0.05, finding a positive correlation value of 0.18795. Maxillary anterior crowding PAR component showed no statistically significant correlations to either the average or the most severely (maximum) upper 3rd molar angulation at any of the six time points.

Time point DC-F was further analyzed according to treatment/control group to assess correlations between 3rd molar angulation and the anterior crowding PAR component, as shown in Table 3-4. Significant correlations between 3rd molar angulation and the anterior crowding PAR component were found in the bionator treated group, but not in the headgear/biteplane or control groups. The average lower 3rd molar angulation and mandibular anterior crowding PAR component showed no statistically significant correlation, but the most severely (maximum) lower 3rd molar angulation and mandibular anterior crowding PAR component showed a statistically significant positive correlation of 0.30649. Although upper 3rd molar did not find any significant correlations overall in DC-F when all treatment groups were combined, it was found that when looking at both the average and most severely (maximum) angulated upper 3rd molar of the bionator group there was a significant negative correlation to maxillary anterior crowding PAR component of -0.33749 and -0.32754 respectively.

Table 3-1. Subject characteristics by treatment group.

Characteristic	Bionator (n=78)	Control (n=78)	Headgear/Biteplane (n=93)	P-value
Sex (% female)	37.18%	37.18%	42.17%	0.7530
Race (% white)	88.46%	91.03%	93.98%	0.4652
Initial molar class severity#				
% mild	31%	28%	31%	
% moderate	27%	26%	24%	0.9822
% high	42%	46%	45%	
No Pre-Treatment	49%	87%	51%	<0.0001
			B vs. HG/BP	0.8100
No Retention after Phase I treatment	51%	100%	48%	<0.0001
			B vs. HG/BP	0.6952

definition of initial molar class severity: mild (bilateral ½ cusp), moderate (at least one side ¾ cusp), or severe (at least one side full cusp).

Table 3-2. Average age of subjects, number of 3^{rd} molars measured per data collection point, and number of subjects who had all 3^{rd} molars removed.

Data Collection	#Panoramic Films Measured	Age (years)	Lower Third Molars Measured	Upper Third Molars Measured	3^{rd} Molars Extracted
End Phase I (DC-3)	98	12.05	156	183	
Retention Post Phase I (DC-5)	164	12.93	270	313	
Baseline at Phase II (DC-7)	178	13.51	296	340	
End of Phase II (DC-F)	175	15.53	320	332	5
One Year into Retention (DC-R1)	93	16.60	163	184	3
Two Years into Retention (DC-R2)	99	17.21	185	189	1

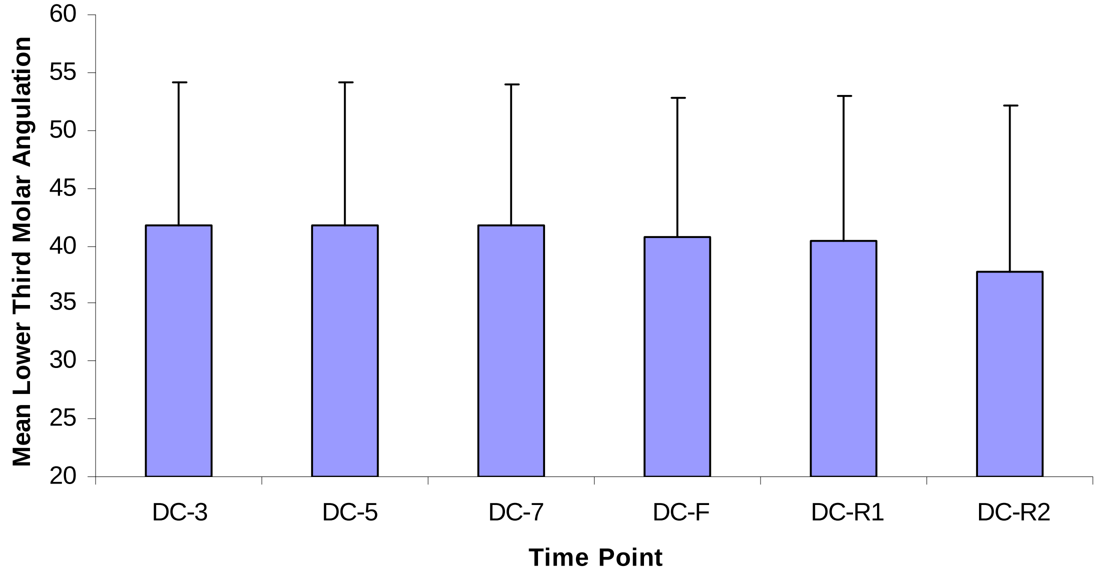

Figure 3-1. Mean lower 3rd molar angulation per time point.

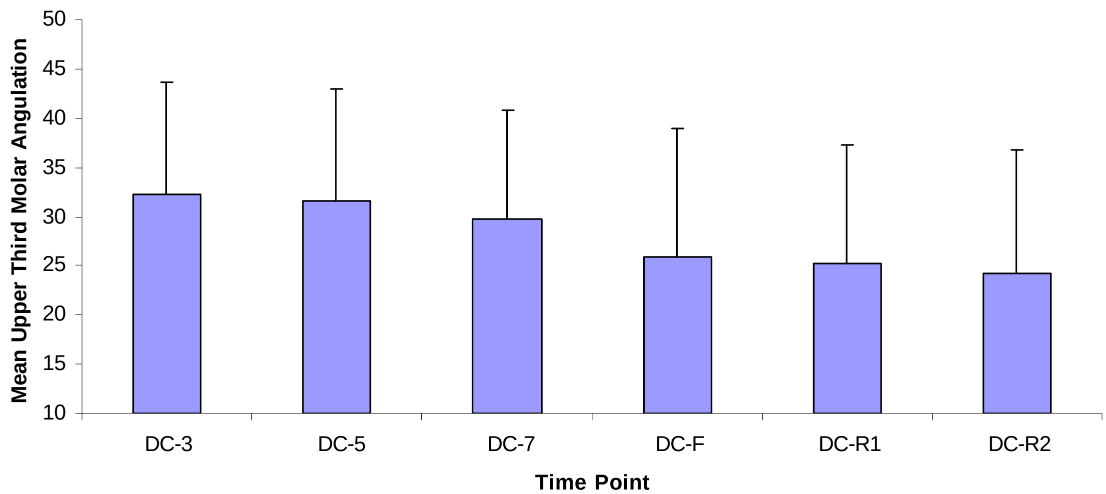

Figure 3-2. Mean upper 3rd molar angulation per time point.

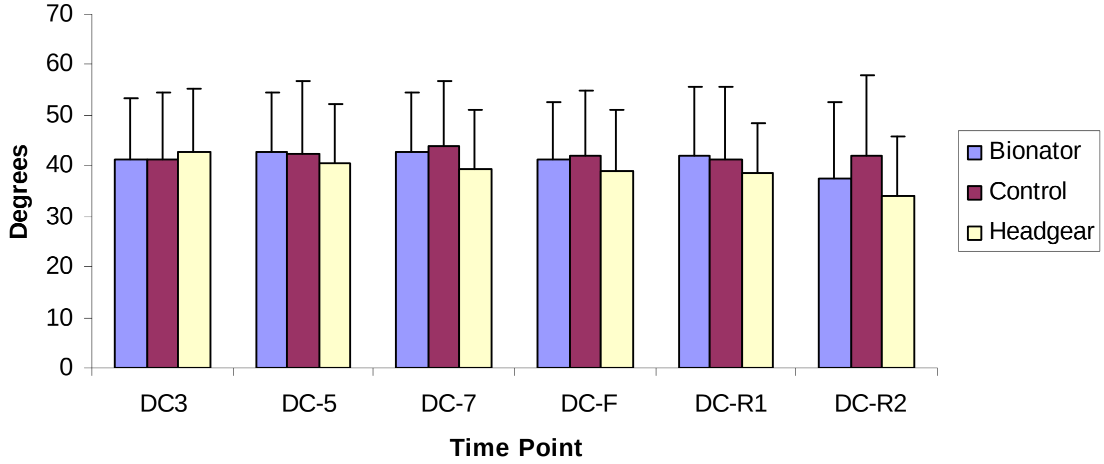

Figure 3-3**.** Mean lower 3rd molar angulation per time point examining Phase I treatment group.

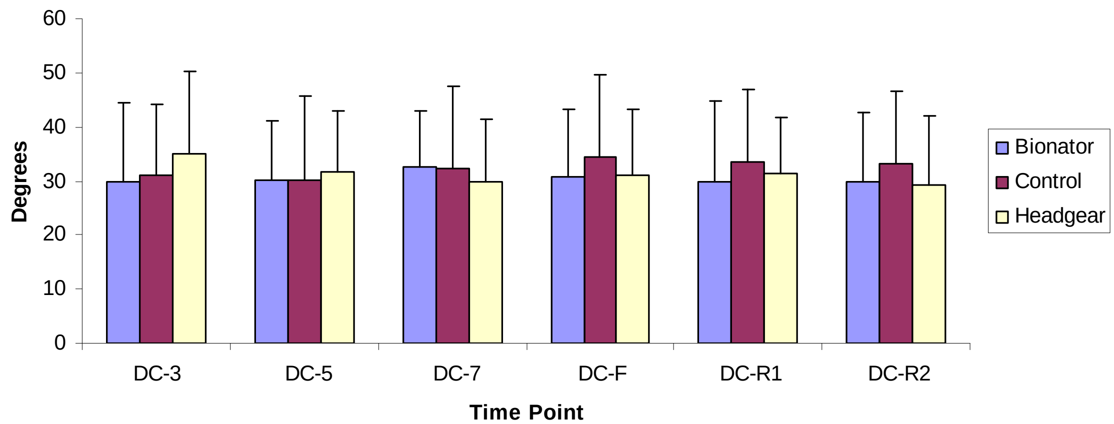

Figure 3-4. Mean upper 3rd molar angulation per time point examining Phase I treatment group.

Table 3-3. Correlation values between 3rd molar angulation and anterior PAR component at various time points.

Time Point	Average Lower 3rd Molar Angulation	Average Upper 3rd Molar Angulation
DC-3	0.881	0.8056
DC-5	0.1159	0.1213
DC-7	0.6847	0.9351
DC-F	0.0462* (0.15544)	0.0156* (0.18795)
DC-R1	0.5269	0.5375
DC-R2	0.1651	0.4143

Spearman Correlation of Coefficient value (* Significant p-value)

Table 3-4. Correlation values between 3rd molar angulation and anterior PAR component at DC-F based on treatment group.

	Bionator	Control	Headgear/BP
Average Lower	0.138	0.8524	0.0697
Maximum Lower	0.0303* (0.30659)	0.8868	0.0706
Average Upper	0.0144* (-0.33749)	0.3282	0.8321
Maximum Upper	0.0178 (-0.32754)	0.4897	0.3457

Spearman Correlation of Coefficient value (*Significant p-value)

CHAPTER 4
DISCUSSION

The purpose of this study was to evaluate three things. One being the changes in angulation of the 3rd molar during its development, the second looking at influences bionator or headgear/biteplane treatment may have on the angulation of the developing 3rd molar, and the third to find if upper and lower anterior crowding PAR components are correlated to 3rd molar angulation. The subjects in this study were Class II patients enrolled in a 2-phase orthodontic treatment where Phase I consisted of bionator, headgear/biteplane, or an observation control group. Of the 239 subjects analyzed in this study, approximately 91% were Caucasian and 62% were males.

The first time point analyzed was DC-3, being that at this point a sufficient number of panoramic films had 1/3 crown calcification of their 3rd molars. Unfortunately, DC-3 is when Phase I treatment has completed and a baseline prior to treatment was not available. At least one 3rd molar was congenitally missing in 18 of the 239 subjects studied. Richardson[43] reported that 9-20% of the population is congenitally missing at least one 3rd molar, which is greater than the 7.53% found in our study. The trend for lower 3rd molar uprighting between DC-3 and DC-R2 are in agreement with the general consensus of 3rd molar development[6, 20], although these subjects and 3rd molars were not one hundred percent coincident and this trend may be misleading. The upper 3rd molar angulation showed a mean uprighting between DC-3 and DC-R2. Standard deviation ranges for the means of both lower and upper 3rd molars encompasses the changes measured.

No statistically significant angulation differences of the lower or upper 3rd molars were found between the bionator, headgear/biteplane, or control treatment groups between the six time points analyzed. Class II early treatment should therefore not be chosen on the assumption that the 3rd molar angulation will be influenced enough to allow eruption of the tooth. Multiple papers have found that the mandibular length increases in bionator or activator treatment when compared to controls.[36, 37, 38] Other papers have suggested that an increase in mandibular length would also increase the retromolar space and promote lower 3rd molar eruption.[13, 39] Keeling[30] found that headgear/biteplane treatment enhanced mandibular growth, but multiple other studies have concluded that headgear treatment does not significantly influence mandibular length.[36, 40, 41, 42] O'Brien[31] found that twin-block Phase I appliances contributed to Class II correction mainly through dentoalveolar effects, which theoretically would encourage mandibular 3rd molar uprighting and maxillary 3rd molar distalization.

Our study did not find a statistically significant difference between mandibular molar uprighting in the headgear group versus the control, although from DC-3 to DC-R2 the headgear/biteplane group uprighted 11 degrees in comparison to the control group which increased its mesial angulation by 1 degree. There may not be a statistical significance when looking at each treatment group per time point, but the overall effect from DC-3 through DC-R2 may hold clinical significance. The bionator group did not show any uprighting effect between DC-3 through DC-F, but mandibular molars did upright a mean of 2 degrees two years into retention. Artun's[44] study examining non-extraction orthodontically treated subjects found the mandibular 3rd molar increased in mesial angulation approximately 7.56 degrees compared with the mandibular plane during treatment (n=16). Our study found that the mean mandibular 3rd molar will upright in both headgear and treatment groups in comparison to controls in the long term. Whether or not this small amount of uprighting is enough to prevent the lower 3rd molar's impaction is yet to be seen. It should be noted that each time group had a different number of subjects whose 3rd molars were analyzed, therefore contaminating the longitudinal nature of the study.

Headgear has been shown to cause distalization of the upper 1st maxillary molar, [26, 30, 32, 33, 34, 36] making us expect the upper 3rd molar to be pushed distal or to have a less likely chance to upright during its development. Although not statistically significant, Figure 3-4 shows that the upper 3rd molar uprighted more in the headgear group than for the bionator or control group. The total uprighting from the end of Phase I until two years out of Phase II was 5.5 degrees. Both bionator and control groups showed no uprighting between these time points. It should also be noted that the headgear treated group had a DC-3 angulation that was 4-6 degrees more mesially inclined than the bionator or control group. It might be that the headgear group was slightly dentally delayed at DC-3 and that this uprighting effect was something that would have occurred despite treatment or an effect that had taken place prior to DC-3 in the bionator and control groups. Artun's[44] study found that the maxillary 3rd molar increased in mesial angulation by approximately 3.34 degrees (n=28) during non-extraction orthodontic treatment in adolescents.

When evaluating the lower 3rd molar angulation to the lower anterior PAR score it was found that the only statistical significance was seen at DC-F time point. Spearman Correlation of Coefficients found a positive correlation of approximately 0.15544 and 0.18795 to the lower anterior crowding PAR component to the average and most severe (maximum) mandibular 3rd molar respectively. This is a mild correlation finding that as the mandibular 3rd molar became more mesially angulated the lower anterior PAR component increased, or showed more misalignment. Studies have suggested that an impaction or mesialized lower 3rd molar effects lower incisor crowding.[24, 25, 26] It is interesting that the only significant time point was DC-F

(Table 3-3), the end of Class II treatment, where alignment should be at its best and where each subject should have a low anterior crowding PAR component score regardless of lower 3^{rd} molar angulation. Statistical significance most likely does not have an effect on clinical significance at this time point. The upper 3^{rd} molar angulation was not found to be statistically significant to a correlation with the upper anterior crowding PAR component in any of the six time points analyzed. Not many previous studies have warranted a reason to look at the upper 3^{rd} molar's angulation effect on the upper anterior PAR component, although Bergstrom's[21] study did not find a correlation.

Since DC-F was the only time point that showed statistical significance to a correlation between 3^{rd} molar angulation and the anterior crowding PAR component, this time point was further analyzed according to treatment group (Table 3-4). The average of the two mandibular 3^{rd} molars no longer showed a significant correlation to lower anterior PAR component, although when looking at the maximum, or most severely angulated, 3^{rd} molar there was a mild-moderate positive correlation with lower anterior PAR component. This suggests that a more severely angulated lower 3^{rd} molar may play more of an influence than two less severely angulated lower 3^{rd} molars. It was interesting to note the only the bionator group was statistically significant and that the maxillary 3^{rd} molars showed a more moderate negative correlation than the mandibular molars' mild positive correlation. The fact that the bionator group showed a moderate correlation between the more uprighted maxillary 3^{rd} molar with the maxillary anterior crowding PAR component cannot be explained by a different mean maxillary 3^{rd} molar angulation (Figure 3-4), since the mean maxillary 3^{rd} molar angulation for the bionator, headgear/biteplane, and control group were within 4 degrees of one another at DC-F. It could be that the bionator group had a wider range of maxillary 3^{rd} molar angulations and that these outliers played a role in the maxillary anterior crowding PAR component. Another theory is that both the lower and upper anterior crowding PAR component may have correlated to one another if overbite and overjet were not finished ideally or had relapsed in retention. It is impossible to know whether it was the Phase-I bionator treatment's effect on the maxillary 3rd molar is what impacted the maxillary anterior crowding PAR component, although it seems unlikely since Phase I treatment ended approximately 3.5 years prior to DC-F.

One problem with this study is that although we were trying to decipher an effect Phase I treatment may have had on angulation, all measurements were analyzed post-Phase I. Another problem is that not all of the same subjects were measured during each time point, which diminishes the longitudinal nature of the study. Patients were randomized into 6 month retention or no retention groups after Phase I, followed by all subjects without retention for an additional 6 months. After Phase II, most patients were given permanent lower lingual retainers, although some were given removable retainers. The type of retention and compliance needed to maintain the alignment may have played a role on the anterior crowding PAR component. As far as using panoramic films to measure angulations, studies have shown that a mean angulation difference of two panoramic films taken of the same dentition can easily result in a 5 degree difference, which may not be clinically significant for most dental diagnoses but does play a large influence in this particular study. [45, 46, 47]

CHAPTER 5
CONCLUSION

We attempted to determine whether there were significant differences in the angulation of the developing 3rd molar and/or their relationship to the anterior crowding PAR component when treated with either a Phase I bionator, headgear/biteplane, or placed in a control group. No angulation differences were found amongst the three Phase I groups. At the completion of Phase II treatment the subjects in the bionator group showed a mild-moderate positive correlation between mandibular 3rd molar angulation and mandibular anterior PAR component, whereas the maxillary 3rd molar angulation and maxillary anterior PAR component revealed a mild-moderate negative correlation. Clinical significance is most likely lacking since the anterior teeth should be well aligned at the conclusion of Phase II treatment.

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BIOGRAPHICAL SKETCH

Noelle Williams grew up in Northport, NY. Her educational accomplishments include receiving her B.S. from Boston College in the field of biology in 2001. She went on to receive here D.M.D. from Harvard School of Dental Medicine. In May of 2008, Noelle will be completing her Master of Science and orthodontic certificate from the University of Florida.