Original Article

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Dentistry Section

Final Maxillary Incisor Inclination in Class II Div 1 Malocclusion Treated with Standard Edge Wises or Straight Wire Appliances

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ABSTRACT

Introduction: There are different orthodontic treatment systems, and currently the most common include standard edgewise and straightwire. Achieving ideal axial inclinations of all teeth at the end of active treatment is regarded as one of the criteria to possess a functional occlusion. As the frequency of use of pre-adjusted edgewise appliance become increasingly prevalent, it is important to compare them with standard edgewise appliances.

Aim: Considering the fact that the buccolingual angle of the crown has significant effect on the treatment outcomes, the present paper aims at comparing the treatment outcomes and buccolingual angle of crowns in patients treated with standard edgewise and straightwire (MBT).

Materials and Methods: This retrospective cohort study compared 100 cephalometric radiographs from 50 class II division 1 patients extracting the maxillary first premolar with twenty-five patients being treated with an edgewise system and 25 patients with straightwire system. The cephalometric landmarks were selected in hard and soft tissue. Linear and angular measurements were used to investigate the soft and hard tissue. U1-SN was used during the cephalometric analysis to measure the inclination of the maxillary incisors. Data analysis was performed using ANCOVA (Analysis of Covariance) at the significant level of 0.05 in SPSS ver. 23.

Results: There was no significant difference between the two study groups in terms of gender and age ($p>0.05$). Also, the buccolingual angle of the crowns was similar between the two groups.

Considering the adjustment of the pre-intervention effect, the mean of the U1-SN after the intervention did not show a statistically significant difference between the two groups ($F=0.01$, $P=0.942$). The result of ANCOVA was significant only for the OCC Plan _FH after the intervention between two groups ($F=4.65$, $P=0.036$).

Conclusion: The present study concluded that the buccolingual angle of the crowns was similar between the two groups.

Keywords: Orthodontic appliance design, Orthodontic brackets, Tooth movement techniques, Torque

INTRODUCTION

Class II malocclusion is one of the most common orthodontic problems that occurs in one-third of the population [1]. It is commonly characterised by an antero-posterior dental discrepancy and skeletal disharmony in severe cases [2]. According to Angle, the distal occlusion of the mandibular first molar in relation to the maxillary first molar should be regarded as the main feature of a Class II malocclusion, moreover, the maxillary incisors present proclination in a Class II division 1 malocclusion [3,4].

Dental extraction strategy is widely accepted for treatment of various types of malocclusions [5,6]. The treatment with the extraction of the first premolars, which is often recommended over non-extraction therapy, is reportedly the most effective protocol when assessed by a normative index [7].

It was in 1960s, when the development of brackets with embedded prescription emerged due to the difficulties associated with desirable implications of the treatment using the standard edgewise approach.

During the first half of the 20th century, various scholars endeavored to integrate the treatment into the appliance, while Andrew should be considered as the pioneer who presented a structure assessment. Andrew's explanation, entitled "Six Keys to Normal Occlusion" and development of the first fully programmed appliance system led revolution in the history of Orthodontics [8,9].

For resolving the drawbacks of the original wire appliance, Roth applied some modifications and amendments on the Andrew's straight wire appliance, and later improvement was applied on the system by McLaughlin (MBT). The afore-mentioned appliance systems, namely, Roth and MBT Pre-adjusted appliance (PEA) system are known as the backbone of the orthodontic mechano-treatment.

The less utilisation of the full-size archwires in the majority of the orthodontic treatments hinders the control. Moreover, the accuracy during the products phase of the brackets will also intensify the consequence; including the undue torque loss in the maxillary anterior segment can be profound [10]. This paper aims at assessing the influence of the standard 019 and MBT 022 system in realisation of the prescribed torque in maxillary anterior teeth [8].

Force is applied to the teeth with bracket-tube in fixed orthodontic treatments. Most of the bracket designs are based the Edgewise Appliance introduced by the Angle in the early 1900s [8]. The introduction of the straight wire appliances in the 1970s was an evolutionary leap that in this system the pre-angled slot bracket provides mesiodistal tipping of the tooth. There is also special gradient in the bracket base to provide the required torque [9]. At the same time, the thickness of the brackets varies so that the tooth finds a proper buccolingual position. Thus, a two-bracket force system can be described using two different methods: Direct straight placed in angled brackets and angled (curved) wire in regular brackets [11].

Obtaining functional occlusion, esthetics, and stability all are among the main applications of Orthodontic treatment. Achieving ideal axial inclinations of all teeth at the end of active treatment is regarded as one of the criteria to possess a functional occlusion. Thus, to control tooth positions in three planes of space, pre-adjusted appliances were developed. The straight wire appliance is the first developed pre-adjusted appliance, and it has been claimed that with these appliances, arch wire bending will be eliminated, treatment time will get shorter, and treatment results will be more consistent. However, the published data do not support this assumption [12].

The MBT appliance first being presented by McLaughlin RP in 1998. They acclaim that the increased palatal root torque in the upper incisors meliorates upon the under-torqued appearance produced by other prescriptions and the increased labial root torque in the lower incisor counteracts the forward tipping during leveling [10].

To date, there have been no published data to defend these claims. At the frequency of use of pre-adjusted edgewise appliance become increasingly prevalent, it is important to consider comparing them with standard edgewise appliances.

The previous studies revealed shifts in torque values of teeth undergone following treatment with pre-adjusted edgewise appliances. Kattner PF et al., observed no difference in the ideal tooth relationship index, as they compared the study models of patients treated using Roth prescription pre-adjusted edgewise appliance and those treated through standard edgewise appliances. The study of Uğur T et al., is in agreement with the findings of Kattner PF et al., [12,13].

Urgur T et al., reported that there was no difference in the measured torque values between the cases in which standard edgewise and a Roth prescription appliance were applied [13].

The objective of this study was to evaluate treatment results and buccolingual inclinations of tooth crowns of patient treated with standard and pretorqued brackets. There is also little information available for comparing the variations in treatment with different types of brackets. The aim of this retrospective study was to compare the dental and skeletal changes, including final torque in class 2 patients undergoing two types of MBT (straight wire) and conventional systems. Previous studies have been carried out with a focus on selfligate brackets, but conventional brackets are routinely used in clinic. For this reason we decided to study conventional brackets instead of selfligate brackets.

MATERIALS AND METHODS

The present study was designed retrospectively in Dental school of Hamadan university of medical science based on the medical records of the treated patients and it was accomplished within 6 months) September 2017-February 2018). A sample size of 26 achieved 90% power to detect a mean of paired differences of 2.0, with an estimated standard deviation of differences of 3.0 and with a significance level (alpha) of 0.05.

Class II div.1 patients were selected from the treated patients in the Department of Orthodontics, Faculty of Dentistry, Hamadan, Iran. The ethical aspect of the present study was approved by Research Ethics Committee of Hamadan University of Medical Sciences, Hamadan, Iran (ID: IR.UMSHA.REC.1396.170) There were a total of 25 patients (16 women and 9 men) in the standard edgewise group and 25 patients (20 women and 5 men) in the standard straightwire group. Subjects having class II Division 1 malocclusion, having a class II molar-canine relationship, desirable treatment termination (possessing a class I canine relationship, regular teeth and overlapping arches), having complete diagnostic records before and after treatment, including appropriate panoramic radiographs, cephalometric radiographs and photographs, history obtained before and after treatment, were included in the study. The exclusion criteria were non-extraction treatment plans, extraction of non-premolar teeth, treatment with functional appliance, use of headgear, surgical cases, any congenital anomaly and missing teeth.

The patients were treated using edgewise and straight wire methods in two equal groups. The first premolars were extracted in both groups. Standard brackets with an 18-inch slot, 17.25-inch wire and MBT brackets with a 22-inch slot and 19.25-inch wire were used respectively in the edgewise and straight wire groups. Cephalometric radiographs were prepared before and after treatment using the same appliance, with a special magnification with head in natural position and lips in rest position. Photographs (photographs that were taken before and after the treatment of the patients) were also be prepared in the natural head position and rest position of the lips. The initial and final cephalometric radiographs of patients and photographs were examined in terms of the soft tissue profile status in order to select the sample. The soft tissue components identified in the cephalometric were juxtaposed with the photographs of the profile view for accurate and non-distortion images. Pre and post-cephalometric landmarks were selected in hard and soft tissue, the accuracy of the points was confirmed by the second individual and in case of disagreement over the location of landmarks, the final conclusion was made by the third observer. Linear and angular measurements were used to investigate the soft and hard tissue status of patients before and after treatment [Table/Fig-1]. U1-SN was used during the cephalometric analysis to measure the inclination of the maxillary incisors before and after the treatment. Finally, measurements and data were also compared in two groups to determine which group had better treatment outcomes based on the information obtained.

Variable name (Unit of measurement	Measurement method	Practical definition for variable
U1-SN (°)	Cephalometric radiographs	The angle between the longitudinal axis of the maxillary incisors with Sella-nasion plan
SNA (°)	Cephalometric radiographs	The anterior angle formed when the A point, S-N planes intersect
SNB (°)	Cephalometric radiographs	The anterior angle formed when the B point, S-N planes intersect
ANB (°)	Cephalometric radiographs	Difference between SNA and SNB
Upper lip thickness (ULT) (mm)	Cephalometric radiographs	The horizontal dimension of the outermost point of the upper lip to the labial level of the maxillary central incisor
Lower lip thickness (LLT) (mm)	Cephalometric radiographs	The horizontal dimension of the outermost point of the lower lip to the labial level of the mandibular central incisor
IMPA (°)	Cephalometric radiographs	The angle between the longitudinal axis of the mandibular central incisor with the mandibular plane (Go-Me)
U1-L1 (°)	Cephalometric radiographs	The angle between the longitudinal axis of the mandibular central incisor with maxillary central incisors
GoGn-SN (°)	Cephalometric radiographs	The angle between the GoGn plane with Sella-nasion plane
Occ.plan-FH (°)	Cephalometric radiographs	The angle between the Frankfort plane with occlusal plane

[Table/Fig-1]: Landmarks were measured on cephalometric radiographs before and after treatment.

STATISTICAL ANALYSIS

Chi square test used to evaluate the difference in frequencies of gender between two groups of study. The Kolmogorov-Smirnov test with 95% CI was used to investigate the Normality distribution of the all quantitative variables. Independent t-test was used to evaluate the difference between the mean changes for all the dependent variables in conventional and MBT bracket groups (before and after intervention). For analysing the effect of groups, ANCOVA test (Analysis of Covariance) was performed for comparing two groups after intervention through adjusting on before intervention value in each dependent variable. The main assumptions of one-way ANCOVA analysis were considered in this paper. The test for assumption of normality using Kolmogorov-Smirnov test, the homogeneity of variance using Levene's test, and homogeneity of regression slopes with the investigation of interaction between the covariate and the independent variable were performed. The significant level of 0.05 in SPSS ver. 23 was considered for analysis of data. U1-SN was used during the cephalometric analysis to measure the inclination of the maxillary incisors.

RESULTS

There were a total of 25 patients (16 women and 9 men) in the standard edgewise group and 25 patients (20 women and 5 men) in the standard straightwire group. Fisher exact test did not show any significant difference between the two groups in terms of gender distribution (p=0.23). The mean age of the patients in the standard and straight wire groups was 17.43±4.8 and 15.92±3.9 years, respectively (p=0.24). The Kolmogorov-Smirnov test with 95% CI was used to investigate the normality distribution of the variables. The results of [Table/Fig-2] showed that except two variables, namely SNB and SNA, based on test all other variables were having normal distribution that after transformation on data, the assumption of normality was established for two variables.

The results of Levene's test in [Table/Fig-3] confirmed that for all dependent variables, the variances (SD squared) were similar for two groups before and after the intervention (p-value >0.05). Also, the result showed that there was no significant interaction between the covariate and the independent variable (p-value>0.05).

According to independent t-test which was used to evaluate the difference between the mean changes for the U1-SN angle in two groups, there was no significant difference between the Conventional brackets and MBT brackets before the intervention (p-value=0.310).

In addition, the result of the ANCOVA test demonstrated that no significant difference was observed between the two groups after intervention in terms of adjustment of the pre-intervention effect. Considering the adjustment of the pre-intervention effect, merely there was a significant difference between the two groups for the OCC Plan-FH variable. The amount of the difference between groups was equal to 1.61±0.56 after intervention (p-value=0.006) (See [Appendix]). Information about all variables are presented in [Table/Fig-3].

Dependent variable	Time	Group I	Group II
		Z statistics (p-value)	
U1-SN	Before	0.15 (0.164)	0.41 (0.200)
	After	0.15 (0.158)	0.11 (0.200)
OCC Plane FH	Before	0.12 (0.200)	0.15 (0.163)
	After	0.10 (0.200)	0.15 (0.182)
G0-Gn-SN	Before	0.15 (0.155)	0.13 (0.200)
	After	0.11 (0.200)	0.11 (0.200)
U1-L1	Before	0.17 (0.051)	0.13 (0.200)
	After	0.16 (0.118)	0.13 (0.200)
IMPA	Before	0.10 (0.200)	0.12 (0.200)
	After	0.18 (0.053)	0.15(0.154)
LLT	Before	0.12 (0.200)	0.10 (0.200)
	After	0.16 (0.086)	0.16 (0.077)
ULT	Before	0.10 (0.200)	0.11 (0.200)
	After	0.12 (0.200)	0.11 (0.200)
ANB	Before	0.14 (0.198)	0.19 (0.200)
	After	0.11 (0.200)	0.09 (0.200)
SNB	Before	0.10 (0.200)	0.18 (0.053)
	After	0.17 (0.074)	0.19 (0.021)
SNA	Before	0.11 (0.200)	0.21 (0.007)
	After	0.20 (0.013)	0.16 (0.091)

[Table/Fig-2]: The results of the Kolmogorov-Smirnov test, Normality of distribution of data for each factor and in both the situation before and after the intervention.

Dependent variable	Time	Group I	Group II	Levene's test for equality of variances	T-test for equality of means	Adjusted for before intervention ancova
		Mean±SD		F-value (P)	T-value (P)	
U1-SN	B	110.88±4.27	110.61±20.35	0.14 (0.708)	1.03 (0.310)	F=0.01 P=0.942
	A	104.93±4.68	104.69±4.13	0.05 (0.829)	0.19 (0.510)	
OCC Plane_FH	B	8.22±2.25	7.07±2.34	0.10 (0.751)	1.81 (0.075)	F=4.65 P=0.036*
	A	8.10 ±1.97	6.50±2.00	0.29 (0.593)	2.86 (0.006)	
G0-Gn– SN	B	32.97±4.02	34.00±5.25	2.38 (0.129)	-0.78 (0.441)	F=1.08 P=0.303
	A	32.93±4.68	33.19±5.58	0.83 (0.367)	-0.18 (0.859)	
U1-L1	B	125.45±10.11	123.08±9.15	0.00 (0.991)	0.87 (0.389)	F=0.25 P=0.618
	A	127.64±7.42	125.72±6.74	0.09 (0.768)	0.96 (0.343)	
IMPA	B	99.19±6.77	96.93±6.77	0.01 (0.916)	1.18 (0.243)	F=0.71 P=0.404
	A	98.36±6.18	97.92±6.57	0.44 (0.512)	0.25 (0.807)	
LLT	B	12.63±2.14	106.61±20.35	0.02 (0.892)	-1.82 (0.074)	F=3.75 P=0.059
	A	15.14±1.50	104.69±4.13	3.86 (0.055)	0.08 (0.939)	
ULT	B	12.49±1.42	13.02±2.08	1.88 (0.176)	-1.05 (0.300)	F=0.34 P=0.562
	A	14.79±1.86	15.38±1.96	0.37 (0.546)	-1.09 (0.282)	
ANB	B	5.94±1.77	5.58±1.74	0.21 (0.648)	0.71 (0.479)	F=0.07 P=0.796
	A	6.01±1.58	5.81±1.86	0.47 (0.497)	0.42 (0.680)	
SNB	B	75.27±3.94	75.06±4.72	0.04 (0.845)	0.17 (0.864)	F=1.87 P=0.178
	A	76.00±4.12	75.26±4.69	0.00(0.997)	0.59 (0.558)	
SNA	B	81.65±4.10	80.65±4.46	0.08 (0.785)	0.82 (0.415)	0.07 0.796
	A	81.42±4.25	80.27±5.29	0.32 (0.574)	0.85 (0.402)	

[Table/Fig-3]: Mean, Standard deviation (SD) and the result of ANCOVA for comparing each dependent variable in the two Conventional and MBT brackets groups.
Group I: Conventional brackets Group II: MBT brackets *p-value>0.05; B: Before A: After

DISCUSSION

Today, having a beautiful smile is very important among patients undergoing orthodontic treatment. Considering the effect of dental torque on the beauty of a smile, paying attention to this issue is of great importance. Andrew conducted a comprehensive research to obtain the first true Straight Wire Appliance (SWA), which should be regarded as an outstanding progression relative to the common edgewise appliance, since in the new appliance the level slot line-up without wire bending is realised. He ascertained that a significant implication on the space requirement for the dental arch was achieved by third key i.e., labio-lingual inclination of teeth to the occlusal plane. The unclosed space distal to the canines or where if all the spaces were closed, the buccal segment relationship might not be Class I. This can be anticipated due to the inadequate torque in the upper labial segment, which necessities the significance of the torque in the maxillary anterior segment [8]. In this study, the final incisor torque was compared in patients treated with MBT and standard appliances. The results of present study did not show any significant differences between MBT and standard brackets in terms of the level of incisor torque in patients treated with these appliances. According to these results, it seems that in patients whose orthodontic treatment was performed by extracting maxillary premolars, the selection of the appliance type is not an important issue anymore, and the type of appliance does not lead to any difference in the incisor torque. The results of this study were consistent with the results of Moesi B et al., study, which was carried out as a retrospective observation to evaluate the comparison of MBT and Roth systems. The results of their study showed that the choice of either of these two appliances does not affect the treatment outcome. They also stated in their study that the type of bracket used had no effect on the clinical judgment of post- treatment beauty [14]. Germane N et al., studied the contour of the facial surface of the teeth and the effect of these surfaces on the facial-lingual angle of the incisors. They stated that the contour of the facial surface was not similar even among similar teeth in different individuals, and this difference extends in each two arches from the anterior to the posterior [15].

Loenen VM et al., also reported that the placement of a bracket 2 and 4.5 mm away from the edge of the central and canine maxillary incisors in similar patients with the same brackets used during the treatment led to a 10-degree torque difference at the end of the treatment, which could be due to presence of different labial crown morphologies [16]. The amount of torque reported in the present study may be due to the wide range of standard deviation observed while expressing the torque level. Another factor that can change the effective torque is the thickness of composite and cement placed under the bracket and tube [12]. Also, the torque expressed is affected by the stiffness of the archwire in such a way that the highest torque will be produced by the stainless steel, Titanium molybdenum alloy (TMA), and then titanium nickel archwires, respectively. It is also stated that the torque expression can be affected by the play value between the archwire and the slot [12-14,16,17]. The final archwire used in our patients in the straightwire system was 0.019×0.025-inch stainless steel in the slot 22. The degree of play of 025×0.019 archwire is about 10.5° in case of this bracket and SLOT combination [18]. However, the final archwire used in the present study was in the 18th slot in the standard 22x16 stainless steel system and previous studies have reported a play value of 10-14 degrees for this bracket-slot combination [12].

It should be noted that although the patients treated in this study were selected from one center, the treatment was carried out by different clinicians; as a result, the difference between the therapists covers every difference between the two groups of brackets. The current study showed that both systems are identical in terms of the amount of torque and the effect on smile beauty, it seems if clinicians used each system properly, there could be no difference in final results and use of each system depends on preference and skills of operator. However, a major goal of the pre-adjusted appliances is to reduce the need to bend the wires and improve the treatment outcomes.

LIMITATION AND FUTURE RECOMMENDATIONS

The limitation of the present study was data collection constrains, as the number of the patients possessing the inclusion criteria discussed in the study was few.

Further studies should be conducted in a prospective manner to meet all homogenization considerations.

CONCLUSION

Achieving ideal axial inclinations for all teeth after application of active treatment is regarded as the criterion for reaching to a functional occlusion. By rapid increase in the use of pre-adjusted edgewise appliance, it is important to compare them with standard edgewise appliances. With regard to the obtained results, it can be concluded that there is no significant differences between MBT and standard brackets regarding the level of incisor torque for patients treated with these appliances. Moreover, patients whose orthodontic treatment was accomplished through extracting maxillary premolars, the selection of the appliance type is not essential, and the type of appliance is not important for any possible difference in the incisor torque.

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Appendix A: The results of t-test between two groups and ANCOVA test for each dependent variable

Independent sample test									
Levene's Test for equality of variances			t-test for equality of means						
	f	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% Confidence Interval of the difference	
								Lower	Upper
Ocepian. after	0.289	0.593	2.856	48	0.006	1.6052	0.56209	0.47503	2.73537

Tests of between-subjects effects					
Dependent Variable: U1sn.after					
Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	260.639a	2	130.320	9.087	0.000
Intercept	96.716	1	96.716	6.744	0.013
U1sn.before	259.943	1	259.943	18.125	0.000
group	0.077	1	0.077	0.005	0.942
Error	674.066	47	14.342		
Total	550191.510	50			
Corrected total	934.705	49			
a. R Squared = 0.279 (Adjusted R Squared=0.248)					

Tests of between-subjects effects					
Dependent variable: oceplan.after					
Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected Model	95.461a	2	47.730	17.759	0.000
Intercept	47.914	1	47.914	17.828	0.000
oceplan.before	63.252	1	63.252	23.535	0.000
group	12.501	1	12.501	4.651	0.036
Error	126.318	47	2.688		
Total	2885.257	50			
Corrected Total	221.779	49			
a. R Squared = 0.430 (Adjusted R Squared=0.406)					

Tests of between-subjects effects					
Dependent variable: G.after					
Source	Type III sum of squares	df	Mean Square	F	Sig.
Corrected model	1088.859a	2	544.429	139.052	0.000
Intercept	0.150	1	0.150	0.038	0.846
G.before	1088.014	1	1088.014	277.888	0.000
group	4.241	1	4.241	1.083	0.303
Error	184.019	47	3.915		
Total	55927.670	50			
Corrected total	1272.878	49			
a. R Squared=0.855 (Adjusted R Squared=0.849)					

Tests of between-subjects effects					
Dependent variable: U1.after					
Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	1103.275a	2	551.637	19.171	0.000
Intercept	1258.070	1	1258.070	43.721	0.000
U1.before	1057.195	1	1057.195	36.740	0.000
group	7.242	1	7.242	.252	0.618
Error	1352.412	47	28.775		
Total	804897.480	50			
Corrected total	2455.687	49			
a. R Squared =0.449 (Adjusted R Squared=0.426)					

Tests of between-subjects effects					
Dependent variable: impa.after					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1006.000a	2	503.000	24.960	.000
Intercept	232.039	1	232.039	11.514	.001
impa.before	1003.535	1	1003.535	49.798	.000
group	14.297	1	14.297	.709	.404
Error	947.158	47	20.152		

Total	483506.510	50			
Corrected total	1953.158	49			
R Squared =0.515 (Adjusted R Squared =0.494)					
Tests of between-subjects effects					
Dependent variable: LLT.after					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected model	88.044a	2	44.022	32.170	0.000
Intercept	48.416	1	48.416	35.381	0.000
LLT.before	88.026	1	88.026	64.327	0.000
group	5.120	1	5.120	3.741	0.059
Error	64.316	47	1.368		
Total	11637.880	50			
Corrected total	152.360	49			
a. R Squared = .578 (Adjusted R Squared=0.560)					
Tests of between-subjects effects					
Dependent variable: ULT.after					
Source	**Type III sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Corrected model	61.344a	2	30.672	12.141	0.000
Intercept	48.992	1	48.992	19.393	0.000
ULT.before	57.016	1	57.016	22.570	0.000
group	0.861	1	0.861	0.341	0.562
Error	118.733	47	2.526		
Total	11556.731	50			
Corrected total	180.076	49			
a. R Squared =0.341 (Adjusted R squared=0.313)					
Tests of between-subjects effects					
Dependent variable: ANB.after					
Source	**Type III sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Corrected model	92.834a	2	46.417	43.000	0.000
Intercept	7.584	1	7.584	7.026	0.011
ANB.before	92.320	1	92.320	85.524	0.000
group	0.073	1	0.073	0.068	0.796
Error	50.735	47	1.079		
Total	1890.565	50			
Corrected total	143.568	49			
a. R Squared = .647 (Adjusted R Squared =0.632)					
Tests of between-subjects effects					
Dependent variable: SNB.after					
Source	**Type III Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Corrected model	880.624a	2	440.312	178.327	0.000
Intercept	0.585	1	0.585	0.237	0.629
SNB.before	872.301	1	872.301	353.283	0.000
group	4.621	1	4.621	1.872	0.178
Error	116.049	47	2.469		
Total	286673.960	50			
Corrected total	996.673	49			
a. R Squared=0.884 (Adjusted R Squared =0.879)					
Tests of between-subjects effects					
Dependent variable: SNA.after					
Source	**Type III sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Corrected model	853.103a	2	426.551	74.884	0.000
Intercept	0.396	1	0.396	0.069	0.793
SNA.before	836.629	1	836.629	146.875	0.000
group	0.386	1	.386	0.068	0.796
Error	267.721	47	5.696		
Total	327924.610	50			
Corrected total	1120.824	49			
a. R Squared = .761 (Adjusted R Squared=0.751)					