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Original Research Article

Comparison of the hard and soft tissue changes of bimaxillary protrusion patients treated with Begg and MBT techniques: a cephalometric study

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ABSTRACT

Background: The effective treatment of bimaxillary protrusion needs a sound knowledge of the mechanics and expertise to control the tooth movement and the unwanted side effects. To obtain a desired finish there is a need to study and compare the mechanics used for correction of bimaxillary protrusion. The aim of this study was to quantify and compare the skeletal, dentoalveolar and soft tissue effects of Begg and MBT mechanotherapies in the treatment of bimaxillary protrusion cases.
Methods: In the present study, cephalometric comparison of the two mechanotherapies, Begg and MBT appliances was done retrospectively. The subjects were selected on the basis of pretreatment characteristics. The sample consisted of 40 patients (20 in each group) with an age range of 12-24 years. Pre- and post-treatment cephalograms were taken and traced on 75µm lacquered polyester acetate tracing papers using a 0.05" lead pencil.
Results: The present study showed that Begg and the MBT appliances were equally effective in treating bimaxillary protrusion with first premolar extraction to satisfactory end results. Treatment with both the appliances resulted in significant amount of upper and lower anterior retraction and achievement of a pleasing facial appearance and profile.
Conclusions: Good torque control, if used in Begg mechanotherapy will result in achieving similar treatment outcome as obtained with MBT technique.

Keywords: Begg mechanotherap, MBT mechanotherapy, Bimaxillary protrusion

INTRODUCTION

Bi-maxillary protrusion includes skeletal or dental discrepancies accompanied by a decrease in inter-incisal angle, proclined incisors and a convex profile often associated with incompetent lips.[1] This is seen in majority of the patient population seeking orthodontic treatment, for functional or esthetic requirements.

In these cases the control of incisor retraction is important, especially in the final finishing phase, to elicit a favourable soft tissue response. Although this response may depend sometimes on soft tissue variability. The result of different treatment mechanics on the hard and soft tissues may vary greatly and these need to be studied, to aid in comparison, for application of the most efficient treatment mechanics in each patient. The hard tissue changes provide a documentation of the underlying soft tissue changes; this is important for understanding the treatment mechanics, response of the tissues and for future reference.

The soft tissue profile changes are of greater importance to the patients, who mostly seek orthodontic treatment for improvement in facial esthetics. Also the restoration of

facial balance and harmony is one of the major goals for an orthodontist.[1] These emphasize the importance of the comparison of the soft tissue changes between the two treatment mechanics.

Various studies have shown that with the Begg treatment there is more tipping of occlusal plane, less reduction of point A and failure to torque the upper incisors sufficiently. With refined Begg technique we may have some control over the torque of upper incisors.

It was also postulated 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.[2]

A study comparing Begg treatment and edgewise treatment group in conjunction with Kloehn type cervical headgear in the edgewise group and concluded that the occlusal planes showed a greater opening with Begg treatment, anchorage loss in maxilla and insufficient torqueing of upper incisors with Begg treatment was also seen.[3]

Another study involved the treatment differences between cases treated with pure Begg and Edgewise mechanics and concluded that the maxillary and mandibular incisors elongated less with Begg appliance.[4] The Begg appliance was reported to tip the occlusal plane and failed to torque the upper incisors sufficiently the mandibular plane was not altered in those cases.[5]

Another research studied influences of age and sex in 154 Class II Division 1 young people between 10 and 18 years of age at the start of treatment. Variations among 3 orthodontic techniques, Begg lightwire, standard edgewise, and straight-wire were also examined. The differences in technique were less root torquing in the Begg group that caused the maxillary incisors to be more upright than in the other groups and more mesial molar crown tipping in the straight-wire group because of using pre-angulated brackets. The patient's age had the greatest influences on translation and mesial crown tipping of the molars (both changes were larger in younger patients) and mandibular growth, which was greatest in younger patients and declined linearly with age.[6]

These studies are in contradiction to the results obtained in a study which compared the efficacy of Begg, Tip-Edge and Pre-Adjusted Edgewise Appliances in Class I Bimaxillary Protrusion Patients using Centroid Analysis and ICON Index and measured change in incisor and molar positions and cephalometrically evaluated dentoalveolar and soft tissue changes. It was seen that the Begg, Pre-adjusted edgewise and Tip-edge appliances were equally effective in treating bimaxillary protrusion to satisfactory end results. The modern Begg appliance with its several refinements, can match newer and more recent appliances, in terms of both treatment changes produced and treatment objectives achieved.[7]

So in view of the above conflicting reports and that no study has yet compared the hard and soft tissue changes obtained with Begg and MBT appliance, the purpose of this research work was to evaluate and compare the hard and soft tissue changes in bimaxillary protrusion patients treated by extraction of all four first premolars with the Begg and MBT mechanotherapies.

The lateral cephalograms which are taken routinely before and after treatment provide a valuable data in this type of evaluation.

The objective of the study was to measure the hard and soft tissue parameters in cephalograms before and after treatment completion with the two mechanotherapies and compare these values in between these two groups.

METHODS

Orthodontic records of the patients who presented at the Department of Orthodontics, KLE Society's Institute of Dental Sciences, Bangalore, India were collected. No specific criteria were set for prescribing the appliances and the patients were arbitrarily divided into two groups—Begg and MBT. The pre- and posttreatment records of all patients who initially presented with an Angle's Class I bimaxillary dentoalveolar protrusion and were treated with the Begg or MBT technique were obtained.

Method of collection of data

Sample size was 40.

Age group included in the study was 16 to 24 years.

Sampling method used was random.

Type of study was retrospective.

Time period of study was from July 2012 to October 2013.

Inclusion criteria

Angle's Class I bimaxillary dentoalveolar protrusion on an underlying Class I or mild Class II skeletal base (0 degrees <ANB <5 degrees). Overbite - 0–4 mm, with 2–3 mm of crowding or spacing. Patients – 16 to 24 years of age. Four first premolars extracted for orthodontic reasons. No headgear or second molar banding or any other anchorage-reinforcing appliance was used. No history of previous orthodontic treatment. No congenitally missing teeth (excluding third molars). Mild to moderate crowding. Convex profiles. Good periodontal status.

Exclusion criteria

Patients with severe crowding. Subjects who have undergone functional appliance therapy or surgical procedure.

The sample consisted of two groups: Group I: Begg appliance. Group II: Pre-adjusted edgewise appliance (MBT Appliance with 0.022 slots).

Each of the above groups consisted of 20 patients.

Treatment mechanotherapies

Begg mechanotherapy

Figure 1-4 represents the Begg appliance treatment methodology. All teeth were bonded and the first molars were banded. After initial alignment, stage I (bite opening) was carried out on 0.016 inch Australian stainless steel archwire (A.J. Wilcock) with Class II elastics (TP Orthodontics) delivering a force of 75 g. After achieving an edge-to-edge bite, stage II (space closure) was performed on a 0.018 inch Australian stainless steel archwire with Class I and II elastics, each delivering a force of 75 g. Stage III (torquing and root uprighting) was performed on a 0.020 inch premium Australian stainless steel base archwire in accordance with Refined Begg technique.

MBT mechanotherapy

Figure 5-7 shows the MBT appliance treatment methodology. For the MBT group, 0.022 inch slot MBT prescription was used. After initial alignment and levelling, en mass retraction was carried out by sliding mechanics using tiebacks on 0.019×0.025 inch stainless steel archwires with approximately 150 g of force at the time of initial activation. Bite opening, if necessary, was undertaken with a suitable intrusion mechanics either in the upper or lower arch. Short Class II elastics were used in some cases during the finishing and detailing phase.

The radiographs were taken in a standardized procedure (in centric occlusion and with lips at rest) before and after completion of treatment in the department of oral radiology. This was done with the subject in standing position, keeping the visual axis parallel to the floor. A standard radiographic exposure comprising of usual parameters viz. 70 kvp, 10 ma and an exposure time of 1.6 seconds was used.

For each patient, lateral cephalograms at pre-treatment and posttreatment were traced on acetate tracing papers (75 µmm) with 0.5mm lead pencil. Single operator had traced the lateral cephalograms. Each cephalogram was traced thrice at an interval of one month and average reading of three was considered. Landmark location error was assessed and the skeletal, dental and the soft tissue measurements were made.

Cephalometric evaluation

The cephalometric hard and soft tissue landmarks and the angular and linear variables which were used to assess the pre and post-treatment effects are depicted in Tables 1, 2 and Figures 8 and 9.

Statistical analysis

Pre- and posttreatment cephalograms of 40 patients were traced and the values recorded. The mean and standard deviation were used for the descriptive statistics. The test of normality was done using Kolmogorov-Smirnov test. For the data which has not followed the normal distribution non-parametric test was used.

Statistical tool (software)

All the statistical analysis was done by statistical package for social sciences software version 17.

A confidence level greater than 5 per cent ($P > 0.05$) was not considered significant.

Before and after comparison in both and hard tissue - paired t- test was used. To determine the differences between pre and post treatment - independent sample t test was used. For the data which has not followed the normal distribution - Mann Whitney U test was used.To determine the method error test - Pearson correlation test was used.

Method error test

Method reliability was determined by retracing and re-measuring 10 randomly selected and traced radiographs one month after the measurements were made, to evaluate intra-operator reliability and reproducibility of various parameters. The mean, standard deviations and standard error were calculated for each parameter. Correlation among various variables was calculated by using Pearson's correlation coefficient (r). No significant differences ($p>0.05$) were found between any of the measured variables. There was no significant variability in reproducing these measurements.

RESULTS

The Begg group

The Begg group showed significant changes in skeletal, dentoalveolar and soft tissue values from pre-treatment to post-treatment, except the basic upper lip thickness.

Skeletal and dentoalveolar changes

The ANB angle showed a decrease of 2.55 degrees, upper incisor to A-Pog and lower incisor to A-Pog value decreased by 15.6 degrees and 5.15 degrees respectively. The linear distances of upper and lower incisors from the A-Pog line were decreased by 6 mm and 2.66 mm respectively. The inter-incisal angle was increased by 19 degrees. The inclination of upper and lower incisors to the occlusal plane increased by 12 degrees and 7 degrees respectively. The angle of facial convexity was decreased by 4.25 degrees (Table 3).

Table 1: Pre-treatment.

	Groups	N	Mean	St. deviation	P value
ANB	BEGG	20	3.45	1.43	0.72 NS
	MBT	20	3.30	1.22	
IIA	BEGG	20	108.80	8.19	0.50 NS
	MBT	20	107.15	7.26	
U1occ	BEGG	20	47.20	5.49	0.87 NS
	MBT	20	47.45	4.17	
L1occ	BEGG	20	54.35	4.59	0.88 NS
	MBT	20	54.10	6.29	
Angle of convexity	BEGG	20	10.70	5.69	0.17 NS
	MBT	20	8.60	3.816	
S Line 1	BEGG	20	5.05	2.41	0.102 NS
	MBT	20	3.92	1.79	
SLine 2	BEGG	20	6.30	2.75	0.980 NS
	MBT	20	6.27	3.40	
E Line 1	BEGG	20	2.32	2.40	0.153 NS
	MBT	20	1.22	2.36	
E Line2	BEGG	20	5.07	2.44	0.712 NS
	MBT	20	4.70	3.78	
Basic lip thickness	BEGG	20	14.45	2.62	0.864 NS
	MBT	20	14.60	2.87	
U Lip strain	BEGG	20	2.25	1.33	0.654 NS
	MBT	20	2.45	1.46	
Nasolabial angle	BEGG	20	89.85	14.50	0.917 NS
	MBT	20	90.30	12.44	
Inter labial gap	BEGG	20	5.92	2.66	0.315 NS
	MBT	20	5.15	2.10	

Table 2: Paired samples test (Begg).

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ANB – ANB post	2.55000	1.27630	.28539	1.95267	3.14733	8.935	19	0.000
Pair 6	IIA – IIA post	-19.05000	11.94053	2.66998	-24.63834	-13.46166	-7.135	19	0.000
Pair 7	U1OCC-U1OCC post	-12.35000	8.43723	1.88662	-16.29874	-8.40126	-6.546	19	0.000
Pair 8	L1OCC-L1OCC post	-7.20000	7.87802	1.76158	-10.88703	-3.51297	-4.087	19	0.001
Pair 9	Angle of convex-angle post	4.25000	3.27470	0.73225	2.71739	5.78261	5.804	19	0.000

Table 3: Paired samples test (skeletal and dentoalveolar changes).

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	SLINE1 - SLINE1 post	2.90000	1.40113	0.31330	2.24425	3.55575	9.256	19	0.000
Pair 2	SLINE2 - SLINE2 post	2.47500	2.55196	0.57064	1.28065	3.66935	4.337	19	0.000
Pair 3	ELINE1 - ELINE1 post	2.87500	2.74281	0.61331	1.59132	4.15868	4.688	19	0.000
Pair 4	ELINE2 - ELINE2 post	3.10000	1.86801	0.41770	2.22574	3.97426	7.422	19	0.000

Continued.

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 5	Basic lip thickness – basic lip thickness post	-.45000	2.30503	.51542	-1.52879	.62879	-.873	19	0.394
Pair 6	Ulip strain – ulip strain post	1.30000	1.17429	.26258	.75042	1.84958	4.951	19	0.000
Pair 7	Nasolabial angle – nasolabial aangle post	-9.10000	9.47518	2.11871	-13.53452	-4.66548	-4.295	19	0.000
Pair 8	Inter labial gap – inter labial gap post	2.77500	1.67391	.37430	1.99159	3.55841	7.414	19	0.000

Table 4: Test statistics.

	SLINE1POST - SLINE1	SLINE2POST - SLINE2	ELINE1POST - ELINE1	ELINE2POST - ELINE2
Z	-3.939[a]	-3.088[a]	-3.047[a]	-3.876[a]
Asymp. Sig. (2-tailed)	0.000	0.002	0.002	0.000
	Basic lip thickness post – basic lip thickness	**Ulipstra In post – ulip strain**	**Naso labial aangle post – naso labial angle**	**Inter labial gap post – inter labial gap**
Z	-1.210b	-3.219a	-3.268b	-3.943a
Asymp. Sig.(2-tailed)	0.226	0.001	0.001	0.000

a. Based on positive ranks. b. Based on negative ranks. c. Wilcoxon Signed Ranks Test

Table 5: Paired samples test (MBT).

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ANB – ANB post	1.70000	0.80131	0.17918	1.32497	2.07503	9.488	19	0.000
Pair 6	IIA – IIA post	-19.25000	10.12488	2.26399	-23.98859	-14.51141	-8.503	19	0.000
Pair 7	U1OCC - U1OCCPOST	-11.25000	6.18040	1.38198	-14.14252	-8.35748	-8.140	19	0.000
Pair 8	L1OCC - L1OCCPOST	-7.70000	6.19932	1.38621	-10.60137	-4.79863	-5.555	19	0.000
Pair 9	Angle of convex – angle post	2.55000	1.93241	.43210	1.64560	3.45440	5.901	19	0.000

Table 6: Paired samples test.

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	SLINE1 - SLINE1POST	2.07500	1.79381	0.40111	1.23547	2.91453	5.173	19	0.000
Pair 2	SLINE2 - SLINE2POST	2.07500	2.02793	0.45346	1.12590	3.02410	4.576	19	0.000

Continued.

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 3	ELINE1 - ELINE1POST	2.57500	2.65208	0.59302	1.33379	3.81621	4.342	19	0.000
Pair 4	ELINE2 - ELINE2POST	1.85000	2.52409	0.56440	0.66869	3.03131	3.278	19	0.004
Pair 5	Basic lip thickness – basic lip thickness post	-.15000	1.75544	0.39253	-0.97157	0.67157	-0.382	19	0.707
Pair 6	Ulip strain – ulip strain post	1.15000	1.18210	0.26433	0.59676	1.70324	4.351	19	0.000
Pair 7	Nasolabial angle – nasolabial aangle post	-8.75000	8.13618	1.81930	-12.55785	-4.94215	-4.810	19	0.000
Pair 8	Interlabial gap – interlabial angle post	2.75000	1.91600	0.42843	1.85328	3.64672	6.419	19	0.000

Table 7: Test statistics.

	SLINE1 post - SLINE1	SLINE2 post - SLINE2	ELINE1 post – ELINE1	ELINE2 post – ELINE2
Z	-3.481 (a)	-3.257 (a)	-3.214 (a)	-2.795 (a)
Asymp. Sig. (2-tailed)	0.000	0.001	0.001	0.005
	Basic lip thickness post – basic lip thickness	**Ulip strain post – ulip strain**	**Nasolabial angle post – nasolabial angle**	**Inter labial gap post – inter labial gap**
Z	-0.354 (b)	-2.994 (a)	-3.325 (b)	-3.739 (a)
Asymp. Sig. (2-tailed)	0.723	0.003	0.001	0.000

a Based on positive ranks. b Based on negative ranks. c Wilcoxon Signed Ranks Test

Table 8: Post-treatment.

	Groups	N	Mean	St. deviation	t-value	P value
ANB	BEGG	20	2.75	1.20		1.00 NS
	MBT	20	2.75	1.16		
IIA	BEGG	20	127.85	9.95		0.616 NS
	MBT	20	126.40	8.05		
U1occ	BEGG	20	59.55	6.03		0.655 NS
	MBT	20	58.70	5.88		
L1occ	BEGG	20	61.55	6.55		0.907 NS
	MBT	20	61.80	6.87		
Angle of convexity	BEGG	20	6.45	3.73		0.750 NS
	MBT	20	6.05	4.14		
	Groups	**N**	**Mean**	**Std. Deviation**	**Std. Error mean**	
S Line 1	BEGG	20	2.2500	1.77334	0.39653	
	MBT	20	1.8500	1.95408	0.43695	
S Line 2	BEGG	20	3.8250	2.61209	0.58408	
	MBT	20	4.2000	2.19089	0.48990	
E Line 1	BEGG	20	-0.5500	2.11449	0.47281	
	MBT	20	-1.3500	2.23077	0.49881	

Continued.

	Groups	N	Mean	St. deviation	t-value	P value
E Line2	BEGG	20	1.9750	1.98994	0.44496	
	MBT	20	2.8500	2.53969	0.56789	
Basic lip thickness	BEGG	20	14.9000	3.00701	0.67239	
	MBT	20	14.7500	2.17340	0.48599	
U Lip strain	BEGG	20	0.9500	.99868	0.22331	
	MBT	20	1.3000	1.17429	0.26258	
Nasolabial angle	BEGG	20	98.9500	12.88604	2.88141	
	MBT	20	99.0500	11.65050	2.60513	
Inter labial gap	BEGG	20	3.1500	2.20705	0.49351	
	MBT	20	2.4000	1.23117	0.27530	

Table 9: Test statistics.

Test Statistics[b]								
	SLINE1POST	**SLINE2 POST**	**ELINE1POST**	**ELINE 2POST**	**Basic lip thickness post**	**Ulip strain post**	**Nasolabial angle post**	**Interlabial gap post**
Mann-Whitney U	184.000	167.000	155.500	146.000	183.500	166.500	192.500	165.000
Wilcoxon W	394.000	377.000	365.500	356.000	393.500	376.500	402.500	375.000
Z	-0.439	-0.902	-1.218	-1.485	-0.451	-0.949	-0.203	-0.971
Asymp. Sig. (2-tailed)	0.661	0.367	0.223	0.137	0.652	0.342	0.839	0.332
Exact Sig. [2*(1-tailed Sig.)]	0.678[a]	0.383[a]	0.231[a]	0.149[a]	0.659[a]	0.369[a]	0.841[a]	0.355[a]

a. Not corrected for ties. b. Grouping Variable: GROUPS

Table 10: Method error test.

	BEGG		MBT	
	Pearson correlation value	**P value**	**Pearson correlation value**	**P value**
ANB	0.962	0.002 HS	1.000	0.001 HS
U1POG1	0.972	0.001 HS	0.982	0.001 HS
U1APOG2	0.983	0.001 HS	0.996	0.001 HS
L1APOG1	0.985	0.001 HS	0.998	0.001 HS
L1APOG2	0.974	0.001 HS	0.988	0.001 HS
IIA	0.987	0.001 HS	0.994	0.001 HS
U1OCC	0.991	0.001 HS	0.996	0.001 HS
L1OCC	0.983	0.001 HS	0.996	0.001 HS
Angle of convex	0.992	0.001 HS	0.985	0.001 HS
	Soft tissue			
	BEGG		**MBT**	
	Pearson correlation value	**P value**	**Pearson correlation value**	**P value**
SLINE1	0.993	0.001 HS	1.000	0.001 HS
SLINE2	0.892	0.017 S	0.996	0.001 HS
ELINE1	0.917	0.010 S	0.998	0.001 HS
ELINE2	0.800	0.056 NS	0.999	0.001 HS
Basic lip thickness	0.441	0.382 NS	0.993	0.001 HS
Ulip strain	0.773	0.071 NS	0.986	0.001 HS
Nasolabial angle	0.998	0.001 H S	0.991	0.001 HS
Interlabial gap	0.985	0.001 H S	1.000	0.001 HS

Soft tissue changes

The distances of the upper and lower lips to the S line increased by 2.9 mm and 2.47 mm respectively. The distances of the upper and lower lips from the E line was increased by 2.87 mm and 3.10 mm respectively. The basic upper lip thickness increased by 0.45 mm which was not statistically significant. The upper lip strain decreased by 1.3 mm. The nasolabial angle increased by 9.1 degrees (Table 4, 5).

The MBT group

The MBT group showed significant changes in skeletal, dentoalveolar and soft tissue values from pre-treatment to post-treatment, except basic upper lip thickness.

Skeletal and dentoalveolar changes

The ANB angle decreased by 1.7 degrees. The angular values of upper and lower incisors to the A-Pog line decreased by 12.9 degrees and 6.4 degrees respectively. The linear values of upper and lower incisors to the A-Pog line decreased by 6.3 degrees and 3.45 degrees respectively. The interincisal angle increased by 19.25 degrees. The inclinations of upper and lower incisors to the occlusal plane increased by 11.25 degrees and 7.7 degrees respectively. The angle of facial convexity decreased by 2.55 degrees respectively (Table 6).

Soft tissue changes

The distances of upper and lower lips from the S line increased by 2 mm each. The distances of upper and lower lips from the E line increased by 2.57 mm and 1.85 mm respectively. The basic upper lip thickness increased by 0.15-25 mm. The upper lip strain was decreased by 1.15 mm. The nasolabial angle was increased by 8.75 mm (Table 7, 8).

Comparison of Begg and MBT groups

No statistically significant differences were found between the groups for any skeletal, dentoalveolar or soft tissue parameters. Each parameter of the Begg and MBT groups were compared at pre-treatment to check for any bias in sample selection. None of the parameters showed any statistical significance showing absence of bias (Table 9, 10).

DISCUSSION

Skeletal and dentoalveolar changes

The present retrospective study shows using any of the two appliances for correction of bimaxillary dentoalveolar protrusion following first premolar extractions, resulted in significant amount of upper and lower anterior retraction and achievement of a pleasing facial appearance and profile.

The present study showed that the changes in the skeletal and dentoalveolar tissues were insignificant when compared between the two groups (Table 8, 10a, 10b).

In recent times, other than comparison between the various prescription-types of the PEA, there have been very few studies comparing older appliances like refined Begg technique with newer ones like PEA MBT and Tip-edge. Hence, in this section, direct comparison of our study with any such study could not be made, except one.[7]

Comparisons were made mostly with results obtained using standard edgewise and classical Begg techniques.

ANB angle

The Begg appliance showed more decrease in this parameter (2.55 degrees) in comparison to MBT appliance (1.7 degrees). The changes were statistically significant but not in between two groups. This contradicted the studies wherein the average ANB reduction was identical (2 degrees) between Begg and PEA and in another wherein ANB angle reduction with Begg was insufficient.[4,2] The change in ANB value was 3.02 mm in the edgewise group in which headgear was used and that for the Begg group was 2.75 degrees.[3] In another study ANB decreased by 1.1 degrees in Begg group, 1.3 degrees in the modified Begg group and 1.5 degrees in the PEA group.[8]

The Begg group had pre-treatment ANB degree slightly more than that of MBT group in this study.

Upper incisor-A-Pog (angular, U1APOG1; linear, U1APOG2)

The Begg appliance showed more decrease in the angular value than the MBT appliance in post-treatment stage (statistically non-significant). No other studies have compared this value between Begg and MBT appliance. In some studies upper incisor to NA was taken as the parameter to assess the changes related to upper incisor angulation whereas in one upper incisor to SN was taken as the parameter.[3,4,7,8] The post-treatment value for this parameter for Begg and MBT appliance was 27.35 degrees and 29 degrees respectively and the linear values 7 mm and 7.1 mm respectively, suggesting that there is some degree of uncontrolled torque component and labially placed roots with respect to central incisors in the cases treated with Begg appliance, with the same amount of retraction in both the groups, due to force being applied on single-point brackets.[9,10,15,16]

Lower incisor – A-Pog line (angular, L1APOG1; linear, L1APOG1)

The two appliances showed similar post-treatment angular values (Begg - 25 degrees, MBT - 25.5 degrees) and linear

values (Begg – 2.47 mm, MBT - 2.9 mm). There was a slightly more decrease in the linear distance in the MBT group. The changes were not significant in between two groups. This was in accordance to some studies and contradicts the study wherein it was shown that there was superior torque control and more retraction of lower incisors in the edgewise group[3,4,7]

Interincisal angle (IIA)

There was no statistically significant change in this value in the two groups but the change was slightly more in MBT group (19.25 degrees, 19.05 degrees). This is in accordance with other studies performed.[3,4,7,11]

Upper incisor to occlusal plane (U1OCC)

The Begg appliance showed more increase in this value from pre- to posttreatment (statistically non-significant). This agrees with the finding that the upper incisors in Begg cases were more palatally inclined in posttreatment stage than in MBT group. This parameter has not been measured in any of the studies done before.

Lower incisor to occlusal plane (L1OCC)

The MBT appliance showed more increase in this parameter. This finding suggests that the lower incisors were more upright in post-treatment stage in the MBT group. This can be due to the use of laceback ligatures used. This is in accordance to some studies.[12,13] But it is in contradiction to the study where the lower incisors retroclined regardless of lacebacks.[14]

Angle of facial convexity (ANGLEOFCONVEX)

The Begg appliance showed more decrease in this parameter (statistically non-significant). This is probably because of less reduction of point A.[2,15]

Soft tissue changes

In the present retrospective study, the changes in soft tissue when compared between two groups were found to be insignificant.

S line to - upper lip (SLINE1), lower lip (SLINE2)

There was more decrease in these parameters with the Begg technique, but not statistically significant. This change was probably because of more labial root torquing action of the Begg appliance.

E line to - upper lip (ELINE1), lower lip (ELINE1)

This value measures the resultant growth in the regions of nose, lips and chin, i.e., the growth of soft tissue along with forward growth of the facial skeleton.[16]

Similarly there was more decrease in these parameters with the Begg appliance than with the MBT appliance.

These results are in agreement with the study where more retraction of the lower incisors in the Begg treatment group was seen that resulted in a significantly greater amount of lower lip retraction.[17]

Basic upper lip thickness (LIPTHICKNESS)

Slightly more decrease in the Begg group was seen.

The upper lip has been reported to respond to upper incisor retraction with a mean movement ratio of approximately 1:3. The corresponding value for the lower lip to lower incisor relation varies between 1:0.4 and 1:0.59.[18-23]

Historically, it has been accepted that the positions of soft tissue points A and B are strongly related to those of the underlying hard tissue points A and B, as well as to the upper incisors.[24,25] Nearly proportionate changes exist in the skeletal points and overlying corresponding soft tissue points.[26]

Some authors have, however, highlighted the more complex functional anatomy and behavior of the upper lip. The fact that upper lip behavior is so complex would help to explain the present findings as well as the previously proposed contention that the behavior of the midfacial tissues shows considerably greater independence of the underlying hard tissue changes than those within the lower face.[27] In addition to that, lip thickness at points A and B increase more than at the vermillion borders with growth.[27,16] A progressive increase in lip length is seen till 15 years of age.

A wide range of ratios of upper lip movement with incisor retraction exist. These differences are related to age, sex, period of treatment, type of malocclusion, and the number of patients in the sample, even complex anatomy of the upper lip, which could not be analyzed by means of cephalometric radiographs for soft tissue evaluation.[28] Other possible sources of variability may be the amount of lip strain, the tonicity and thickness of the soft tissue, growth type and racial groups.[28-30] Individual variations are more prominent in lower lip and even in non-growing patients.[31,32] The upper lip response is related to both upper and lower incisor movement, mandibular rotation, and the lower lip. Lower incisor movement do not correlate with change of either the upper or lower lip.[32]

With respect to lip changes in maxillary premolar extraction in class II treatment the soft tissue lip changes were most likely to be related to the pre-existing morphology of the lips themselves, while upper incisal changes were mainly related to their own pre-treatment positions and changes occurring with treatment in the underlying bony structures.[33]

An increased pre-treatment vermilion lip thickness might provide some protection against a significant reduction in the depth of lip curvature, even in the presence of potentially adverse skeletal or dental changes. If dental and skeletal factors have been well managed during treatment, the posttreatment depths of lip curvature should be satisfactory. This soft tissue compensation are influenced by the pre-treatment vermilion thickness of the upper and lower lips.[34]

Upper lip strain (ULIPSTRAIN)

The MBT appliance showed more decrease in this parameter, possibly because of bodily retraction of incisors.

Nasolabial angle

This parameter shows more decrease with the Begg appliance. This angle was found to show variability in posttreatment values. In the Begg group, four patients showed decrease in this angle after treatment. In the MBT group, two patients showed decrease in the posttreatment values and in one patient the nasolabial angle has remained the same.

This is in accordance with a study which stated that there is great individual variability in the effects of treatment. If any generalization regarding flattening of profile with extraction is to be made, clearly the great majority of patients exhibit controlled amounts of profile change that produce improvements in facial esthetics. The strongest associations for change in nasolabial angle were seen with inherent soft tissue factors, such as pre-treatment lip thickness. This is also consistent with the strong associations that have been reported previously between thinner, flatter, pre-treatment upper lips and greater increases in nasolabial angle during treatment.[35]

This is consistent with previously published findings that the soft tissues themselves are in fact the ultimate compensators in the facial profile and that the inherent characteristics of the lips will greatly influence any response to orthodontic treatment.[18,33]

Interlabial gap

The change in this parameter is almost the same for both the treatment mechanics.

The soft tissue findings are in accordance with the study wherein the changes in lip position resulting from orthodontic treatment were relatively insignificant. Muscle tonicity has a considerable influence on lip form and position but in general, variation in lip position occur only when supporting alveolar bone and tooth position changed beyond a certain level.[36]

Limitations of the study

The cephalograms represent two dimensional changes, so three dimensional changes cannot be accurately predicted. A bigger sample size would more accurately depict variations in treatment changes.

Scope for future studies

The present study can be conducted in different population groups to see the changes for inter-population comparison. A long-term stability of the treatment effects can be compared in between the two groups by means of a longitudinal study. A CBCT study needs to be performed to assess and compare the torque expressed in the anterior teeth between the two groups.

CONCLUSION

The following conclusion can be drawn from the present study with the Begg and MBT techniques: No statistically significant skeletal or soft tissue changes were obtained when inter-group comparisons were made. Statistically significant difference between pre-treatment and post-treatment values was obtained in each group. The upper incisors showed more palatal inclination in the Begg group as compared with the MBT group but this difference was not statistically significant. The amount of retraction of the incisors in relation to A-Pog line linearly was the same in both the groups. There were variable soft tissue responses in the two groups. The Begg appliance is effective in severely proclined incisors in which case tipping movement is more preferred. However caution is needed to prevent the tipping movement in some cases.

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