Posttreatment changes in different facial types

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Following the completion of orthodontic and orthopedic changes, teeth and their supporting structures have a tendency to move in the direction of the original malocclusion.[1-25] Such changes are attributed to either "physiologic rebound" of the tissues[15,23] or to normal development.[15,26-40]

Factors that may influence posttreatment change are usually attributed either to the type of treatment or to biologic mechanisms., A third factor, facial type, may also affect posttreatment changes. Normal vertical variations in facial relationships have been noted by many investigators as an expression of differing patterns of growth.[3,10,38,52-69]

A number of parameters have been used to categorize vertical facial type, including the cant of the mandibular plane,[10,38,52,53,61-66] cant of the palatal plane,[56] ratios of anterior and posterior face heights,[10,38,52-54,56,58,59,63] as well as the structural morphology of the mandible.[53] Different terminologies have been used to describe face types: short, average and long facial types;[38] poor and good facial patterns,[10] forward and backward rotators;[53,65] hyperdivergent, neutral and hypodivergent growth patterns;[54] as well as dolichocephalic and brachycephalic types.[55] Regardless, it

Abstract

The purpose of this study was to describe and compare the changes occurring during and after orthodontic treatment in three facial types: short, average and long.

Sixty-six subjects with Class II, Division 1 malocclusion were evaluated. All cases were treated nonextraction, using a fixed edgewise appliance and extraoral forces. The lateral cephalogram and dental casts for each patient were measured at three different stages: pretreatment, immediately after appliance removal and at least two years posttreatment.

There was a wide range of individual variation in posttreatment change for the various skeletal and dental parameters measured. With few exceptions, the three facial types did not show significant differences in posttreatment change. The relative protrusion of maxillary incisor tip (U1:A-Pog) tended to increase after treatment in the long face type while it tended to decrease in the short face type. Long face females, when compared with all other groups, showed greater posttreatment incremental increase in anterior face height as well as the greatest posttreatment decrease in maxillary arch length. Males expressed greater posttreatment incremental increases in the various linear measurements of face height than females.

Differences in posttreatment change for the different facial types do not require special retention consideration.

Key Words

Face type • Cephalometrics • Dental arch • Posttreatment changes

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Table 1
Ages of subjects in years at different stages of treatment and average treatment and posttreatment time.

Treatment Stage	SFT N = 20				AFT N = 26				LFT N = 20			
	FEMALES N = 10		MALES N = 10		FEMALES N = 16		MALES N = 10		FEMALES N = 10		MALES N = 10	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Pretreatment (T1)	11.3	1.8	11.7	1.4	11.0	1.4	11.1	1.0	10.9	1.8	12.4	1.5
End of treatment (T2)	13.6	1.5	14.1	1.5	13.4	1.2	14.1	1.2	13.1	1.6	14.1	1.6
Posttreatment (T3)	16.2	2.0	16.1	1.4	16.1	2.0	16.7	1.9	17.1	2.2	16.5	1.7
Treatment time *	2.1	1.2	2.0	0.7	1.7	1.0	2.5	1.3	1.9	1.2	1.4	0.6
Retention time	2.6	1.0	2.0	0.2	2.7	1.2	2.6	1.1	3.9	1.4	2.3	1.0

SFT = Short Face Type AFT = Average Face Type LFT = Long Face Type
*The average treatment time is calculated from the time treatment actually started until the time of debanding.

seems that the vertical facial pattern is established early in life and although often maintained, can be altered during subsequent periods of growth.[33,57,58]

Some posttreatment changes in the vertical parameters of treated and growing individuals reflect the combined effects of residual growth as well as tissue "rebound" to the orthodontic and orthopedic movements. Furthermore, the clockwise or counterclockwise mandibular rotation[30,33,34] that accompanies growth and treatment may affect the final result.[30,31,33,34]

Investigators have also suggested that various facial types behave differently in terms of growth and treatment response.[4,33-40,38,57-60] As an example, subjects with a long face express more of a mandibular backward rotation when compared with subjects with short faces.[4,38]

Facial type may influence the changes that occur following orthodontic treatment.[33,37,50,70] Several investigators[4,71-73] observed that changes in mandibular incisor position may be, at least in part, influenced by the direction of mandibular growth. Björk[3] noted that the forward rotation of the mandible present in the short facial type influences the path of eruption of the teeth and that in extreme cases, it increases the potential for deepening of the bite and enhances mandibular incisor crowding after treatment.

Other investigators[35,74] did not find any significant correlation between face type and dental changes.

The purpose of this investigation was to determine whether posttreatment changes differ between three basic facial types—short, average and long—in subjects treated for Class II, Division 1 malocclusions without the extraction of permanent teeth.

Materials and methods

The criteria used in the selection of the sample were as follows: (1) All patients had a Class II, Division 1 malocclusion and were treated without the extraction of permanent teeth and with edgewise appliances and extraoral forces. (2) None of the patients had congenital anomalies, significant facial asymmetries or congenitally missing teeth. (3) Records available for each patient included dental casts and lateral cephalometric X-rays, obtained prior to and immediately following orthodontic treatment. The type of extraoral appliance used was dependent on the judgment of the clinician and included using either cervical or high pull force. This judgment was essentially based on the individual's facial type. A third set of records was obtained a minimum of 2 years following the completion of orthodontic treatment. Removable retainers were used in most cases for approximately 1 year. (4) All patients were treated to an acceptable occlusion, i.e., a Class I molar and canine relationship, overbite of 10% to 25% with a well-aligned and interdigitated dentition. The last criterion insured that the posttreatment changes were not caused by poor treatment results.

The above criteria had the disadvantage of limiting the number of patients that could be included in the study. Conversely, they increased the homogeneity of the sample by excluding variables such as extractions and type of malocclusion that might influence interpretation of the posttreatment changes. Approximately 1200 sets of records were examined and only 66 cases met all the stated criteria.

The mean ages of the individuals at the three stages evaluated [T1, T2 and T3] are presented in Table 1.

Identification of the three facial types

The subjects were divided into three groups according to facial pattern: short, average and long facial types. Assignments were based on an evaluation of the following facial parameters: (1) The ratio of posterior face height to anterior face height.[10,38,68] (2) The inclination of the mandibular plane relative to the anterior cranial base.[38,52,53,69,75] (3) The inclination of the mandibular plane relative to Frankfort horizontal plane.[10,38,67,76,77] The first two parameters are based on anatomical landmarks, while the third involves a plane of orientation. This approach insured that neither anatomic variation nor inaccurate orientation would influence ranking of the cases. For each of these three facial parameters, all subjects were rank ordered and divided into three groups. Concordance in the ranking was then determined.

Using these three parameters, 41 subjects were correctly identified, but a discrepancy was present in the ranking of 15 subjects (23%). As a result, the pretreatment cephalograms were further evaluated clinically by two orthodontists in order to place each subject in the appropriate group. The relative position of sella and nasion as well as proper canting of the Frankfort horizontal plane were evaluated in order to detect significant variation in positions of the landmarks. Clinical judgments were guided by the identification of various structural signs for mandibular rotations suggested by Björk:[3] inclination of the condylar head, curvature of the mandibular canal, shape of the lower border of the mandible, inclination of the symphysis, interincisal angle, interpremolar and intermolar angles, and anterior lower face height.

The 66 subjects were divided accordingly into the following subgroups: 10 males and 10 females with short facial type (SFT); 10 males and 16 females with average facial type (AFT); and 10 males and 10 females with long facial type (LFT).

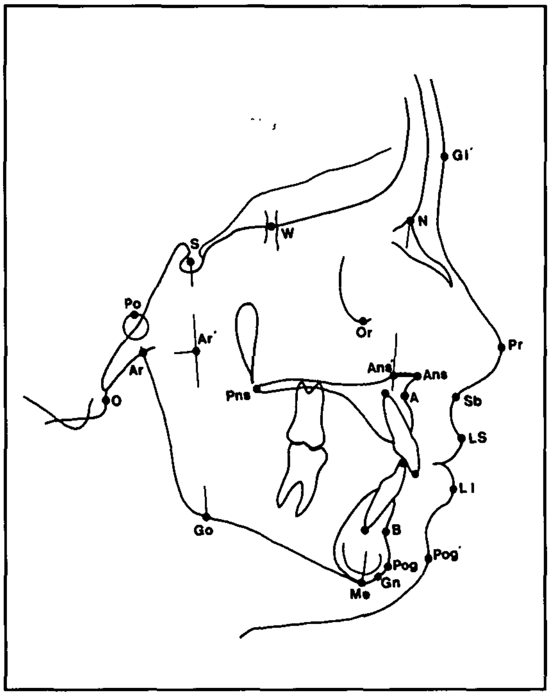

Figure 1

Figure 1
Landmarks used.

Cephalometric landmarks and measurements

The landmarks identified on each cephalogram are presented in Figure 1.[78-81] The midpoints of all bilateral landmarks were used.

From these landmarks 33 linear and angular measurements were constructed:[10,80,81] NSO, SNA, SNB, SNPog, FH:NPog, NSGn, FH:SGn, SWPog, MP:SN, MP:FH, ANB, NAPog, Pal:MP, N-Me, A-Ans', Ar'-Go, S-Go, N-Ans'/N-Me, S-Go/N-Me, Ar'-Go/S-Go, U1:L1, U1:SN, L1:FH, L1:MP, U1:APog, L1:NB, Pog:NB, Overjet, Overbite, Holdaway Angle, G1':Sb:Pog', LS:Pr-Pog' and LI:Pr-Pog'.

Dental arch measurements

Arch width: Maximum rectilinear distances were measured between the distal contact points of the lateral incisors, the cusp tips of the canines, the buccal cusp tip of the second premolars and the mesiobuccal cusp tip of the first molars.[82,83]

Arch length: The anterior and posterior arch segments were measured for the right and left sides.[84]

Tooth size: The mesiodistal crown diameter was taken as the distance between the anatomic contact points[85,86] for all the teeth mesial to the first molars.

Tooth size-arch length discrepancy (TSALD): Total TSALD mesial to the first molars and an-

Table 2
Significant results of the analysis of variance general linear models procedure comparing the cephalometric changes at the various stages between the three facial types.

Variable	Treatment Changes [T2-T1] F-Value	Treatment Changes [T2-T1] P-Value	Posttreatment Changes [T3-T2] F-Value	Posttreatment Changes [T3-T2] P-Value
FH:NPog	3.89	0.0256	N.S.	
FH:SGn	3.99	0.0234	N.S.	
MP:FH	4.25	0.0186	N.S.	
Ar'-Go mm	3.15	0.0495	N.S.	
N-Ans'/N-Me %	3.69	0.0304	N.S.	
U1-APog mm	N.S.		4.09	.0213

N.S. = Not significant

terior TSALD between the two canines were calculated. Crowding was recorded as a negative score and spacing was recorded as a positive score.[26]

Reliability of measurements

Each landmark was identified by one orthodontist and checked for accuracy by another. To minimize measurement errors, all linear and angular measurements were obtained by two investigators working independently.

For dental cast measurements, a digital caliper (Digimatic caliper, Mitutoyo Corporation, Tokyo, Japan) accurate to 0.01 mm was used. Cephalometric measurements were obtained using a computerized digitizing regime (Dentofacial Planner 4.22, Dentofacial Software Inc., Toronto, Canada). Inter- and intrainvestigator discordance was predetermined at 0.5° and 0.5 mm; measurements that exceeded these limits were retaken.

Statistical analysis

The total sample was divided into six subgroups: females and males for each of the three facial types. Analysis of variance, General Linear Models Procedure (GLM) and Duncan's Multiple Range Test were used to compare the various subgroups. The independent variables considered were sex and facial type, and were analyzed at the three treatment stages: pretreatment (T1), end of treatment (T2) and posttreatment (T3). F-values were calculated from the GLM procedure and if significant at $P \geq 0.05$, then Duncan's multiple range test was performed. The Duncan's test is a multiple comparisons test used to compare the means in order to pinpoint subgroup differences found in the GLM.[87]

Results

Age comparisons between groups

The analysis of variance, General Linear Model Procedures, indicated that there were no significant differences in the ages of the six subgroups at the various treatment stages.

No significant differences were found between the sexes or between the various facial types, in either the treatment or posttreatment time intervals. One exception, the posttreatment time in LFT females, was at least 1 year longer than the other subgroups (P=0.0059). This finding is not considered to significantly influence the interpretation of results.

A. Cephalometric changes

Male-female comparisons within each face type

Comparisons of the posttreatment changes between males and females indicate that most of the significant differences were in the linear dimensions of face heights, namely, S-Go (P=.04) and N-Me (P=.04). These differences indicate the presence of larger incremental changes in males than in females. Such differences are to be expected and have been observed in other investigations.[70,76-78] The treatment (T2-T1) changes in the incisor overbite were also significantly different (P=.002) between sexes. These differences were related to the presence of a greater overbite in males before treatment.

Since only a few significant differences were present in the comparisons of cephalometric changes between males and females (8 out of 99 comparisons), it was decided to combine both sexes within each facial type.

Comparisons of the treatment changes (T2-T1)

Only the significant ($P \leq .05$) results of the analysis of variance General Linear Model Procedures comparing the skeletal, dental and soft tissue parameters are presented in Table 2. The results of Duncan's Multiple Range Test for these parameters are detailed in Table 3.

Cranial base, maxillary, dental and soft tissue relationships: No significant differences were present between the three facial types in the treatment changes of these parameters.

Mandibular relationships (Table 3): Comparisons between treatment changes in the three facial types indicate that the facial angle (FH:NPog) increased during treatment in the

SFT, while it decreased in both the AFT and LFT. On the other hand, FH:SGn and MP:FH angles increased in all groups during treatment, with a significantly greater increase in the AFT than in the LFT and SFT.

Face heights and their ratios (Table 3): The treatment changes in the ratio of upper to total anterior face heights (N-ANS'/N-Me) significantly decreased in the SFT and increased in the AFT and LFT.

Comparisons of the posttreatment changes (T3-T2)

Cranial base, maxillary, mandibular and soft tissue relationships: No significant differences were present in these parameters between the three facial types.

Face heights and their ratios (Table 3): The posttreatment changes in the ratio of upper to total anterior face heights (N-ANS'/N-Me) indicate a significant decrease in the LFT while in the SFT and AFT it changed very little.

Dental relationships (Table 3): Posttreatment changes in the maxillary incisor position (U1:APog) indicate a significant increase in the relative protrusion of the incisor tip in the LFT and a decrease in the SFT.

B. Dental cast measurements

The analysis of variance, General Linear Model Procedures, comparing changes in the dental cast measurements are presented in Table 4.

The results of the analysis of variance indicate that a number of significant differences were present between males and females within each facial type (Table 5). As a result, comparisons of the incremental changes in the dental arch parameters will be presented separately for males and females.

Treatment changes (T2-T1)

Maxillary arch widths (Table 5): The results of the analysis of variance comparing treatment changes in the maxillary arch widths indicate that in females, arch width at the second premolars and first molars had a larger increase during treatment in the LFT than in the AFT and SFT.

Mandibular arch widths (Table 4): No significant differences were present between the three facial types in either males or females in these parameters.

Maxillary arch lengths (Table 4): No significant differences were present between the three facial types in either males or females in these parameters.

Mandibular arch lengths (Table 5): A significantly greater decrease in the total mandibu-

Table 3
Results of Duncan's multiple range tests detailing the significant differences in the comparisons of the cephalometric changes between the three facial types at various stages.

Variable	P value	Mean	Group letter	Subgroup
Treatment Changes				
FH:NPog	0.0256	0.18	A	SFT
		-0.73	A B	LFT
		-2.39	B	AFT
FH:SGn	0.0234	4.02	A	AFT
		1.70	B	LFT
		1.31	B	SFT
MP:FH	0.0186	3.41	A	AFT
		1.24	B	LFT
		0.54	B	SFT
N-ANS'/N-Me %	0.0304	0.19	A	LFT
		0.05	A	SFT
		0.60	B	AFT
Posttreatment changes				
N-ANS'/N-Me %	0.0272	0.06	A	SFT
		-0.02	A	AFT
		-0.56	B	LFT
U1-APog	0.0213	0.59	A	LFT
		0.00	A B	AFT
		-0.33	B	SFT

Note: Subgroups with the same letter are not significantly different

Table 4
Results of the analysis of variance general linear models procedure comparing the dental arch changes for the three facial types at various stages.

Variable	Treatment Changes F-Value	Treatment Changes P-Value	Posttreatment Changes F-Value	Posttreatment Changes P-Value
Maxillary				
Arch width at premolars	3.52	0.0075	N.S.	
Arch width at molars	2.53	0.0380	N.S.	
Total arch length	N.S.		3.46	0.0081
Mandibular				
Left posterior arch length	2.85	0.0224	N.S.	
Total arch length	2.86	0.0221	N.S.	

N.S. = Not significant

Table 5
Results of Duncan's multiple range tests detailing the significant differences in the comparisons of the incremental dental arch changes between the three facial types at various stages.

Variable	P value	Mean	Group letter	Subgroup
Treatment Changes				
Maxillary arch width at premolars	0.0075	5.11	A	LFT Female
		3.08	B	AFT Female
		2.38	B	SFT Male
		2.34	B	AFT Male
		2.01	B	LFT Male
		1.70	B	SFT Female
Maxillary arch width at first molars	0.0380	3.39	A	LFT Female
		2.60	A B	SFT Male
		1.75	A B	AFT Female
		1.25	B	AFT Male
		1.18	B	LFT Male
		0.68	B	SFT Female
Mandibular left posterior arch length	0.0224	-0.22	A	LFT Male
		-0.76	A B	SFT Male
		-0.90	A B	SFT Female
		-1.15	A B C	AFT Female
		-1.85	B C	LFT Female
		-2.27	C	AFT Male
Mandibular total arch length	0.0221	-0.01	A	LFT Male
		-0.10	A	SFT Male
		-0.55	A	SFT Female
		-0.70	A	AFT Female
		-1.93	A B	LFT Female
		-3.86	B	AFT Male
Posttreatment Changes				
Maxillary total arch length	0.0081	-0.58	A	SFT Female
		-0.67	A B	LFT Male
		-0.68	A B	AFT Male
		-0.88	A B	AFT Female
		-1.43	B C	SFT Male
		-1.87	C	LFT Female

Note:Subgroups with the same letter are not significantly different

lar arch length in males occurred during treatment in the AFT than in the LFT and SFT.

Posttreatment changes (T3-T2)

Maxillary and mandibular arch widths (Table 4): No significant differences were present between the three face types in males and females in any of these parameters.

Maxillary and mandibular arch lengths (Table 5): Results of the analysis of variance indicate that females with the LFT showed a significantly greater total maxillary arch length decrease than SFT and AFT.

Discussion

In clinical studies, the collection of a homogeneous sample of orthodontically treated patients is an arduous task, since it results in a reduction of the pool of patients from which the sample is to be drawn. The major advantage of such an approach is that it enhances the validity of the data. As a result, the selection of patients in the present study was limited to those with the same type of malocclusion; i.e. Class II, Division 1, treated with a fixed edgewise appliance. All patients had the same age range as well as comparable treatment and posttreatment times and the sample was divided equally into males and females.

The present study was conducted to gain some insight into factors that influence posttreatment change.

Posttreatment cephalometric changes

The findings from this study indicate that, in general, posttreatment changes in the cranial base, maxillary, mandibular and maxillary-mandibular relationships were not significantly different between the three facial types studied.

One of the few parameters which showed a significant posttreatment change was the ratio of upper to total face height, which decreased in the LFT while it remained unchanged in the SFT and AFT. This finding indicates that anterior face height increased more in the long face groups following treatment. Similar findings occur with normal growth.[33,88]

In addition, during the posttreatment observation period, the maxillary incisors (U1:APog) in the LFT, tended to become relatively more protrusive, whereas they tended to become slightly retrusive in the SFT. The differences may be related to the tendency for pogonion to be more prominent in the short facial type.

Posttreatment dental arch changes

The present findings indicate that there were a number of differences in the incremental changes between males and females. On the other hand, the only significant differences in posttreatment changes between the various facial types were in comparisons of the maxillary arch length with the LFT females showing the greatest decrease following treatment. Similar results were also noted by Sakuda et al.[89] who found that maxillary and mandibu-

Table 6
Frequency distribution of the treatment and posttreatment changes of selected dental arch parameters in the three facial types.

Change	SFT				AFT				LFT			
	T2-T1		T3-T2		T2-T1		T3-T2		T2-T1		T3-T2	
	N	%	N	%	N	%	N	%	N	%	N	%
a. Mandibular intercanine width												
≤-3 mm	1	5			2	8						
-2.9 / -2 mm			2	8								
-1.9 / -1 mm	3	15	5	25	3	12	2	8	5	25	3	15
-0.9 / -.25 mm		8	40	4	15	6	23		5	25		
no change	4	20	2	10	4	15	7	27	2	10	5	25
0.25 / 0.9 mm	4	20	4	20	5	19	10	38	3	15	5	25
1 / 1.9 mm	4	20	1	5	2	8	1	4	8	40	2	10
2 / 2.9 mm	2	10			3	11			1	5		
≥3 mm	2	10			1	4			1	5		
Mean		0.52		-0.41		0.00		0.00		0.55		-0.03
SD		1.75		0.86		1.77		0.62		1.6		0.75
b. Mandibular intermolar width												
≤-3 mm					1	4						
-2.9 / -2 mm	1	5			3	11	1	4				
-1.9 / -1 mm	3	15			9	36	2	8	2	10	3	15
-0.9 / -.25 mm	2	10	6	30	3	11	3	11	2	10	4	20
no change	4	20	5	25	2	8	3	11	3	15	2	10
0.25 / 0.9 mm	2	10	5	25	1	4	7	27	2	10	4	20
1 / 1.9 mm	4	20	4	20	3	11	6	24	6	30	6	30
2 / 2.9 mm	4	20		3	11	3	11	2	10			
≥3 mm					1	4	1	4	3	15	1	5
Mean		0.5		0.22		-0.33		0.56		1.14		0.38
SD		1.49		0.73		2.54		1.21		1.59		1.31

lar crowding was more pronounced with vertical jaw growth and was less with horizontal mandibular growth.

Frequency distribution of posttreatment changes for selected parameters

In order to better appreciate the degree of variability in posttreatment changes in the various facial types, it was decided to examine the frequency distribution of posttreatment changes in a number of parameters that are of clinical importance.

Changes in the mandibular plane angle: Treatment changes (T_2 - T_1) in MP:SN for the three face types were almost equally distributed between an increase or a decrease; as an example, MP:SN of the SFT decreased in 45% of the patients and increased in 45% of the patients. For the AFT, the MP:SN angle decreased in 31% of the patients and increased in 58% of the patients. In the LFT, the angle decreased in 40% of the patients and increased in 55% of the patients.

Posttreatment (T_3 - T_2), most of the patients showed a decrease in MP:SN angle. Decreases occurred in 80%, 71% and 85% of the patients in the SFT, AFT and LFT respectively. These findings indicate that the trend in posttreatment changes of the MP:SN angle was essentially the same in all three facial types, i.e., it mostly decreased. The magnitude of the decrease ranged between 0.5 degrees and 4 degrees.

A similar trend was also observed in earlier studies. Glenn, Sinclair and Alexander[50] noted a backward mandibular rotation during treatment and a forward rotation after treatment. Schudy[33] and Sinclair and Little[36] noted a decrease in MP:SN angle after treatment. Bergersen,[59] on the other hand, observed that subjects with a steep MP:SN angle remained unchanged while those with a low MP:SN angle decreased.

Changes in anteroposterior mandibular position: The majority of patients showed an increase in the SNPog angle during and following treatment. The percentage of patients that showed an increase in the SNPog angle was much greater in the SFT during (70%) and following (80%) treatment than the other two groups. The corresponding values for the AFT were 46% and 53% and for the LFT the values were 40% and 60% respectively. These findings suggest that following treatment, the chin point tends to move anteriorly more often in the SFT than in the other two groups. Schudy[33] reported similar changes.

Changes in ANB angle: As expected, the ANB angle in most of the patients tended to decrease or remain unchanged both during and following treatment in all facial types. The angle decreased or remained unchanged in 80% of the SFT, 85% of the AFT and 95% of the LFT during treatment. Following treatment, it decreased or remained unchanged in 80% of the SFT, 77% of the AFT and 90% of the LFT. The decrease that occurred after treatment was less than 2 degrees in a majority of the cases.

Glenn, Sinclair and Alexander[50] and Schudy[33] also found that the ANB angle tended to decrease with treatment.

Changes in overjet and overbite: Incisor overjet decreased in all of the patients with treatment and increased in most of the patients posttreatment. The percentage of patients that showed a posttreatment increase in overjet was much higher in the SFT (80%) than in the AFT (58%) and the LFT (65%). In most patients (92% to 95%) the posttreatment change in overjet was less than 2 mm. These findings agree with those of Bersonis and Grewe[90] and Sadowsky and Sakols[91] who found that overjet increased slightly after treatment. Other investigators found that overjet either does not change after treatment[46,50,92] or even tends to decrease.[49]

The mandibular arch showed a similar posttreatment decrease in arch length in most of the patients; 90% in the SFT, 73% in the AFT and 85% in the LFT. Only two patients showed a posttreatment increase in arch length and the increase was less than 2 mm. The present findings are similar to those of other investigators.[41,46,47,49,50,92-97] Furthermore, Dacre[98] noted a decrease in the posttreatment mandibular anterior arch length even after the extraction of one incisor.

Overbite decreased during treatment in all the patients except for one in each group and subsequently increased in most patients after treatment. The overbite increase following treatment differed in the three facial types. Overbite increased in 80% of the patients with SFT, with only 10% of the patients experiencing a decrease. In the AFT, 69% of the patients showed an increase while 23% showed a decrease. In the LFT, 50% of the patients showed an increase in overbite and 30% showed a decrease. These findings indicate that the return of overbite tends to be more in the SFT than in the other two facial types.

Posttreatment increases in overbite were also reported by a number of investigators.[26,33,49,92] Others[46,50] reported that overbite remained unchanged after treatment.

Changes in mandibular arch width (Table 6): Mandibular arch width changes during and after treatment received considerable interest in the literature. In this study, the mandibular intercanine width primarily increased during treatment and either decreased or did not change in most of the patients after treatment. During treatment, it increased in 60%, 42% and 65% of the patients in the SFT, AFT and LFT respectively. The number of patients that showed a posttreatment decrease in intercanine width was much greater in the SFT (65%) than in the AFT (31%) and the LFT (40%). In most of the patients, the posttreatment change was less than 1 mm of decrease or increase. The decrease in intercanine width after treatment was also reported in the literature.[41,46,49,50,92-96,99]

Mandibular intermolar width increased during treatment in 50% of the SFT, 65% of the LFT. In the AFT, 62% of the cases showed a decrease. After treatment, 45% of the SFT patients showed a continued increase while 30% experienced a decrease. In the AFT, 23% of the patients showed a decrease and 66% experienced an increase, and in the LFT 35% of the patients showed a decrease while 50% experienced an increase. Little, Wallen and Riedel[95] reported on a sample treated with premolar extractions and found that intermolar width consistently decreased after treatment. Glenn, Sinclair and Alexander[50] mentioned that mandibular intermolar width decreased in 60% of their sample, which consisted of nonextraction cases. Gardner and Chaconas[94] reported that intermolar width did not show any change in their sample following treatment.

Conclusions

The findings from this investigation indicate that facial type does not play a significant role in the stability of orthodontic treatment results. The reported trends observed should provide the orthodontist with a better understanding of posttreatment stability in the different face types studied.

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