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Research Article

Predicting Treatment Success Of The Functional Therapy in Class II Division 1 Patients

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Predicting Treatment Success Of The Functional Therapy in Class II Division 1 Patients

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Abstract

Objective: The aim of this study was to determine the cephalometric variables that may predict treatment success of the Twin Block appliance in patients with skeletal class II division 1 malocclusion.

Materials and Methods: Patients treated with the Twin Block appliance were recruited from the archive of the clinic. They were divided into 2 groups as success and failure according to the change in ANB angle. By the 6th month after treatment, patients with a change in ANB angle of 3° or more were included in the success group (14 patients; 7 females, 7 males). Patients with a change of 1° or less were included in the failure group (14 patients; 5 females, 9 males). Seventy-five variables were measured on the pre-treatment lateral cephalograms and the groups were compared. For each variable that showed a statistically significant difference between the two groups, the percentage of correct classifications was calculated.

Results: Of the seventy-five variables, fifteen showed a statistically significant difference between the two groups ($p < 0.05$). The percentages of correct classification ability of the variables varied between 82% and 57%. The variables with the highest classification success were as follows: Pg-NB (mm) (82.1%), U1NA (°) (78.6%), and L1-NB (mm) (75%).

Conclusions: The variables with the highest predictive ability showed that patients with a prominent chin tip, protrusive upper incisors and retrusive lower incisors were more likely to be successfully treated with the Twin Block appliance.

Key Words: Prediction, treatment success; twin block appliance.

Introduction

Class II division 1 is a common type of malocclusion in society, which is not only aesthetically disturbing but also causes functional problems due to the increased possibility of trauma to the upper incisors. Trehan et al. and Al Jadidi et al. reported a prevalence of 5.5% and 11%, respectively, in the populations they studied (1,2). Although the amount varies from study to study, it is one of the main reasons why patients consult orthodontists. In their study, Willems et al. found that 52% of patients undergoing orthodontic treatment had Class II Division 1 malocclusion (3).

Functional appliances are valuable therapeutic tools for skeletal correction in Class II subjects characterised by mandibular retrognathia in the pubertal or prepubertal period (4,5). Despite minor differences in configuration, these devices share a common mechanism of action.

The Twin-Block appliance was designed and introduced by Clark in 1982 and has since become one of the most widely used functional appliances (4,6). Because it consists of two separate parts, it has advantages over other removable functional appliances such as more comfortable speech and partial movement of the lower jaw, increasing patient comfort and cooperation (4,5).

Although some researchers have suggested early treatment to reduce the possibility of upper incisor trauma (7), it has been shown that the pubertal growth spurt is the optimal time for maximum skeletal correction in the minimum amount of time (8,9). In clinical practice, functional appliances usually do excellent work if treatment is performed at the optimal time. They correct Class II molar and canine relationships, eliminate increased overjet-overbite, and improve the soft tissue characterized by a retracted mandible, resulting in a better profile.

However, we have observed that sometimes, even when we follow the same treatment procedure and do not have problems with patient co-operation, successful results are short-term. In these patients, during the fixed orthodontic treatment, which was the second phase of treatment, the overjet increased and the corrected canine and molar relationships were disrupted. We had to modify our treatment plan to eliminate the overjet by using the fixed functional appliance, class II intermaxillary elastics, or by extracting the upper first premolars.

There are many conflicting results in the literature about the success of the skeletal effects of functional appliances (10-13). The aim of this study was to investigate whether there

are any cephalometric predictors that can be used to predict the success of the Twin Block appliance.

Materials And Methods

This study was approved by the Clinical Research Ethics Committee of Tokat Gaziosmanpaşa University and informed consent forms were obtained from the parents of the patients. The clinical archive of the Orthodontic Department of Tokat Gaziosmanpaşa University was searched retrospectively. A total of 323 Class 2 Division I patient records were detected and patients treated with the Twin Block appliance between 2013 and 2020 and were identified. As a routine procedure in our clinic, Twin Block treatment were used for 6-8 months, wearing it for 18 hours daily, followed by an additional 3-4 months of night-time wear. The patients' final records were obtained 6 months later after the treatment.

The inclusion and exclusion criteria were listed in Table 1. In cases that met the inclusion criteria, ANB angles were measured before the treatment and at the end of the retention period. Cases with a decrease in ANB angle of more than 3° due to functional treatment were classified as successful, and those with a decrease of less than 1° were classified as unsuccessful. Cases with a decrease between 1° and 3° were considered borderline and excluded from the study. As a result of the measurements, 14 patients (5 females, 9 males) and 14 patients (7 females, 7 males) were allocated into the failure and success groups, respectively.

Table 1. Inclusion and exclusion criteria

Inclusion Criteria
Having Class II division 1 malocclusion with an ANB angle more than 6°
Being at the CVMS 3 or CVMS 4 maturational stage at the beginning of the treatment
Not having a history of cooperation problem during treatment
Having complete pre-post treatment and post retention cephalometric records
Exclusion Criteria
Receiving rapid maxillary expansion (RME) or headgear therapies as a part of the treatment
Having craniofacial anomaly
Having poor image quality in cephalometric records

A total of seventy-five measurements were carried out using thirty-three cephalometric landmarks on pre-treatment lateral cephalometric radiographs. Tracings and measurements were made by using Dolphin Imaging software (Dolphin Imaging & Management Solutions,

Chatsworth, CA, USA). The landmarks, angular measurements, and linear measurements used in the study were shown in Figure 1, 2, and 3, respectively.

To determine the measurement error, twelve radiographs were randomly selected, and the cephalometric tracings and measurements were repeated after two weeks. The method error between the first and second measurements was calculated using the Dahlberg formula $\sqrt{(\Sigma d^2/2n)}$. The angular measurements showed errors ranging from 0.24° (ANB °) to 1.89° (Articular angle), while the linear measurements showed errors ranging from 0.22 mm (Po-NB) to 1.68 mm (Co-Gn).

Statistical analysis

The data were analysed using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, version 22.0; Armonk, NY: IBM Corp.). Statistical significance was defined as p-values less than 0.05.

To compare variables between the success and failure groups, an independent samples t-test was used for variables with a normal distribution, and the Mann-Whitney U test was used for variables with a non-normal distribution. In order to determine the classification success of the variables that showed statistical significance, the variables analysed with the Independent Samples t-test were subjected to a discriminant analysis, while the variables analysed with the Mann-Whitney U test were subjected to a logistic regression analysis.

The Independent Samples t-test was used to assess whether there was a statistically significant difference between the groups in terms of treatment times. The effect of gender on treatment success was assessed using the chi-squared test.

Results

No significant difference was observed between the success and failure groups in terms of treatment duration. ($p=0.286$; mean duration (success): 10.17 ± 2.00 months, mean duration (failure): 9.32 ± 2.16 months) There was no significant association between the success status and the gender of the participants. ($\chi^2=0.583$, $p=0.445$)

The comparison results of the variables with normal distribution, evaluated by independent samples t-test, were presented in Table 2. As a result of the analysis, statistically significant differences ($p<0.05$) were found between the success and failure groups in fourteen variables: 1-) U1-SN (°), 2-) U1-PP (°), 3-) U1-NA (°), 4-) FMIA (°), 5-) OP-FH (°), 6-) Li-B'-Pg' (°),

7-) N-Me (mm), 8-) L1-NB (mm), 9-) Pg-NB (mm), 10-) Li-E (mm), 11-) Li-H (mm), 12-) Overjet (mm), 13-) L6-MP (mm), 14-) L1-MP (mm).

The variables that did not show a normal distribution were evaluated using the Mann-Whitney U test and the results are presented in Table 3. Except for the L1-NB/Pg-NB, no significant difference was observed between the groups in other variables.

The 14 variables that showed significant differences between the groups as a result of the t test were analysed separately by discriminant analysis and the data related to the classification success of the variables are presented in Table 4. The highest percentage of correct classification (82.1%) was found for the variable Pg-NB (mm). A logistic regression analysis was performed for the variable L1-NB/Pg-NB, which showed a significant difference between the groups as a result of the Mann-Whitney U test. According to the results, if the value of L1-NB/Pg-NB increases by 1 unit, the odds of failure increased 1.6-fold. L1-NB/Pg-NB correctly classified the groups by 75%.

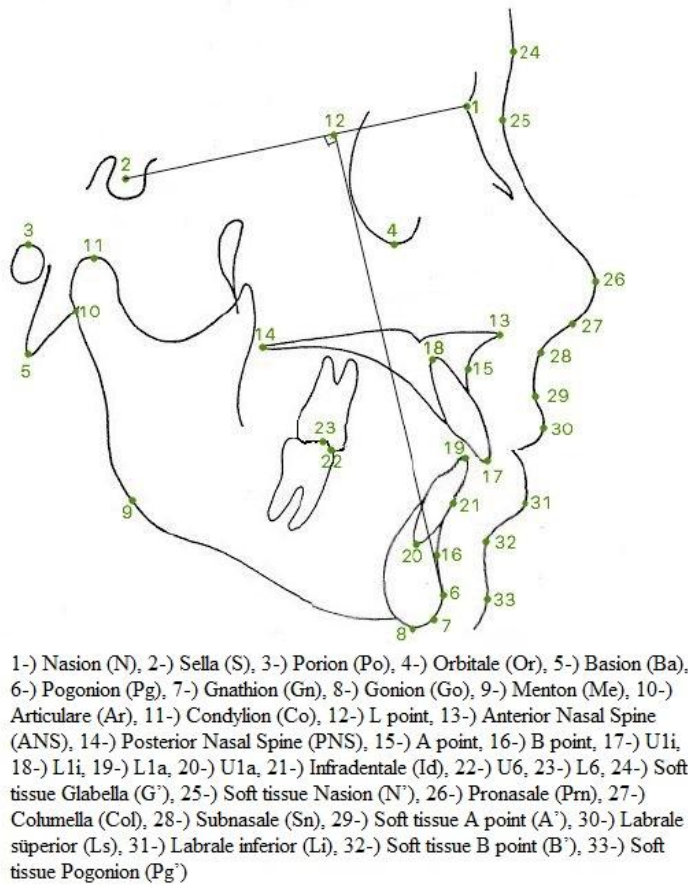
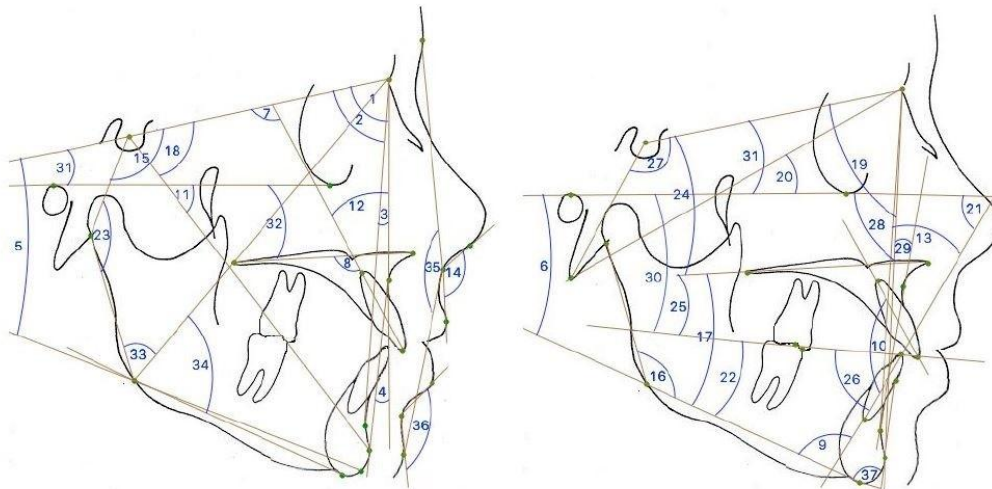
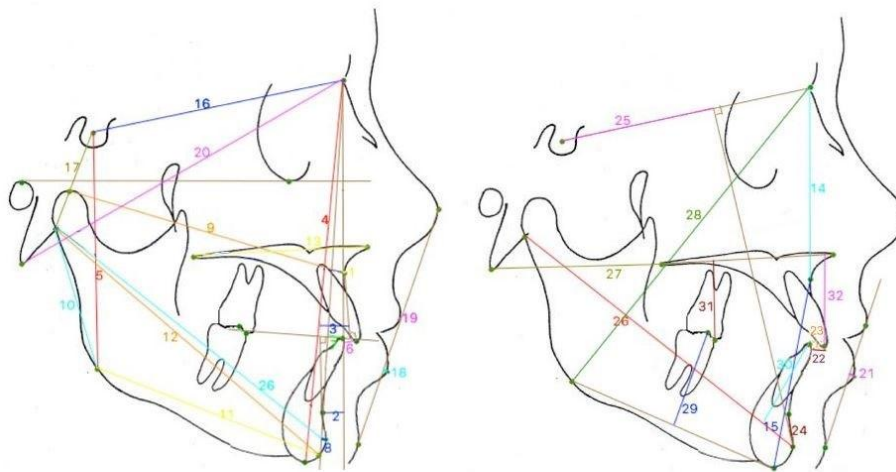


Figure 1: Landmarks used in the study.



1-) SNA ($^{\circ}$), 2-) SNB ($^{\circ}$), 3-) ANB ($^{\circ}$), 4-) (NA-APog ($^{\circ}$), 5-) SN-GoGn ($^{\circ}$), 6-) FMA ($^{\circ}$), 7-) U1-SN ($^{\circ}$), 8-) U1-PP ($^{\circ}$), 9-) IMPA ($^{\circ}$), 10-) Interincisal angle ($^{\circ}$), 11-) SGn-FH ($^{\circ}$), 12-) U1-NA ($^{\circ}$), 13-) L1-NB ($^{\circ}$), 14-) Nasolabial angle ($^{\circ}$), 15-) Saddle angle ($^{\circ}$), 16-) Gonial angle ($^{\circ}$), 17-) PP-MP ($^{\circ}$), 18-) SGn-SN ($^{\circ}$), 19-) SN-NPog ($^{\circ}$), 20-) Cranial deflection angle ($^{\circ}$), 21-) FMLA ($^{\circ}$), 22-) OP-MP ($^{\circ}$), 23-) Articular angle ($^{\circ}$), 24-) SN-PP ($^{\circ}$), 25-) OP-PP ($^{\circ}$), 26-) L1-OP ($^{\circ}$), 27-) SN-Ba ($^{\circ}$), 28-) Facial angle ($^{\circ}$), 29-) NPg-AB ($^{\circ}$), 30-) OP-FH ($^{\circ}$), 31-) FH-SN ($^{\circ}$), 32-) FH-PP ($^{\circ}$), 33-) Ar-Go-N ($^{\circ}$), 34-) N-Go-M ($^{\circ}$), 35-) Facial convexity angle ($^{\circ}$), 36-) Labiomental angle ($^{\circ}$), 37-) IdPg-MP ($^{\circ}$)

Figure 2: Angular measurements used in the study.



1-) A-Nperp (mm), 2-) Pg-Nperp (mm), 3-) Wits appraisal (mm), 4-) N-Me (mm), 5-) S-Go (mm), 6-) U1-NA (mm), 7-) L1-NB (mm), 8-) Pg-NB (mm), 9-) Co-A (mm), 10-) Ar-Go (mm), 11-) Go-Gn (mm), 12-) Co-Gn (mm), 13-) ANS-PNS (mm), 14-) N-ANS (mm), 15-) ANS-Me (mm), 16-) S-N (mm), 17-) S-Ar (mm), 18-) Lower lip-E-plane (mm), 19-) Upper lip-E-plane (mm), 20-) N-Ba (mm), 21-) Lower lip-H line (mm), 22-) Overjet (mm), 23-) Overbite (mm), 24-) B-Pg (mm), 25-) S-L (mm), 26-) Ar-Pog (mm), 27-) PNS-Ba (mm), 28-) N-Go (mm), 29-) L6-MP (mm), 30-) L1-MP (mm), 31-) U6-PP (mm), 32-) U1-PP (mm), 33-) Co-Gn (mm), 34-) N-ANS/ANS-M (mm), 35-) L1-NB/Pg-NB (ratio), 36-) S-Go/N-Me (ratio), 37-) S-Ar/Ar-Go (ratio), 38-) S-N/Go-Gn (ratio)

Figure 3: Linear and rational measurements used in the study.

Table 2. Comparison of variables with normal distribution

Variable	Group	Mean	Standard	t	P ^a
SNA (°)	Success group	80.57	4.07	-0.005	0.996
	Failure group	80.58	2.85		
SNB (°)	Success group	73.91	3.77	-0.119	0.906
	Failure group	74.06	3.22		
ANB (°)	Success group	6.68	1.81	0.328	0.746
	Failure group	6.48	1.39		
NA-APo (°)	Success group	11.56	4.31	-0.485	0.631
	Failure group	12.24	2.97		
SN-GoGn (°)	Success group	32.91	5.64	-1.081	0.289
	Failure group	35.07	4.93		
U1-SN (°)	Success group	109.90	7.33	2.280	0.033*
	Failure group	104.76	4.19		
U1-PP (°)	Success group	119.27	5.61	2.604	0.015*
	Failure group	114.26	4.50		
IMPA (°)	Success group	98.58	7.37	-0.658	0.516
	Failure group	100.31	6.56		
SGn-FH (°)	Success group	62.92	4.22	-0.807	0.427
	Failure group	64.09	3.41		
U1-NA (°)	Success group	29.31	5.66	2.837	0.009*
	Failure group	24.20	3.69		
Nasola-bial angle	Success group	115.76	7.16	0.169	0.867
	Failure group	115.22	9.467		
Saddle angle	Success group	127.71	7.39	1.162	0.256
	Failure group	124.94	4.96		
Gonial angle	Success group	129.21	3.67	-1.687	0.107
	Failure group	132.54	6.38		
PP-MP (°)	Success group	25.90	5.75	-1.194	0.243
	Failure group	28.20	4.34		
SGn-SN (°)	Success group	69.92	4.22	-0.807	0.427
	Failure group	71.09	3.41		
SN-NPog (°)	Success group	75.54	3.78	0.487	0.630
	Failure group	74.89	3.35		

NBa-FH (°)	Success group	29.59	2.84	-0.132	0.896
	Failure group	29.71	2.27		
FMIA (°)	Success group	58.17	6.72	2.351	0.027*
	Failure group	52.66	5.65		
OD-MD (°)	Success group	20.21	2.09	-0.469	0.644
	Failure group	20.78	4.06		
Articuler angle	Success group	138.37	7.76	-0.742	0.465
	Failure group	140.20	4.98		
SN-PP (°)	Success group	9.38	4.09	-0.077	0.940
	Failure group	9.49	3.27		
OD-PP (°)	Success group	5.70	4.78	-1.084	0.288
	Failure group	7.41	3.45		
L1-OD (°)	Success group	61.23	6.61	1.055	0.301
	Failure group	58.92	4.82		
SN-Ba (°)	Success group	134.77	6.59	1.905	0.068
	Failure group	130.57	4.97		
FH-NPo (°)	Success group	87.57	2.67	1.931	0.064
	Failure group	85.53	2.92		
OP-FH(°)	Success group	3.06	3.28	-2.318	0.029*
	Failure group	6.26	3.99		
FH-SN (°)	Success group	12.03	2.33	1.555	0.132
	Failure group	10.64	2.38		
FH-PP (°)	Success group	-2.64	3.38	-1.167	0.254
	Failure group	-1.16	3.36		
Ar-Go-N (°)	Success group	54.88	3.16	-0.213	0.833
	Failure group	55.18	4.22		
N-Go-Me (°)	Success group	74.32	4.63	-1.852	0.075
	Failure group	77.36	4.02		
G'-Sn-Po' (°)	Success group	155.71	4.63	1.231	0.229
	Failure group	153.54	4.67		
(Li-B'- Pg') (°)	Success group	110.56	11.15	-2.782	0.010*
	Failure group	122.49	11.54		
İdPg-MP (°)	Success group	70.64	5.51	-2.050	0.051
	Failure group	74.85	5.36		
	Success group	2.56	3.41	1.248	0.223

A-Nperp	Failure group	1.17	2.37		
Pg-Nperp (mm)	Success group	-4.37	4.64	2.039	0.052
	Failure group	-8.36	5.67		
Wits (mm)	Success group	7.12	3.17	1.074	0.293
	Failure group	5.91	2.79		
N-Me (mm)	Success group	107.16	6.08	-2.356	0.026*
	Failure group	113.01	7.04		
S-Go (mm)	Success group	68.85	4.13	-1.509	0.143
	Failure group	71.46	4.97		
U1-NA (mm)	Success group	5.53	1.77	0.048	0.962
	Failure group	5.50	1.32		
L1-NB (mm)	Success group	5.05	2.30	-3.098	0.005*
	Failure group	7.38	1.62		
Pg-NB (mm)	Success group	2.8	1.02	3.986	0.000*
	Failure group	1.51	0.77		
Co-A (mm)	Success group	83.66	5.96	-0.620	0.540
	Failure group	84.97	5.16		
Ar-Go (mm)	Success group	43.45	3.85	0.141	0.889
	Failure group	43.26	3.38		
Co-Gn (mm)	Success group	107.07	5.84	-1.054	0.302
	Failure group	109.43	6.00		
ANS-PNS (mm)	Success group	53.84	3.93	-0.027	0.979
	Failure group	53.87	2.96		
N-ANS (mm)	Success group	50.74	3.25	-1.468	0.154
	Failure group	52.56	3.32		
ANS-Me (mm)	Success group	59.87	5.24	-2.036	0.052
	Failure group	63.92	5.28		
S-N (mm)	Success group	65.98	3.02	-1.527	0.139
	Failure group	68.11	4.26		
S-Ar (mm)	Success group	31.84	3.30	-1.722	0.097
	Failure group	33.90	3.02		
Li-E (mm)	Success group	-0.19	2.17	-2.266	0.032*
	Failure group	2.10	3.09		
Ls-E (mm)	Success group	-0.24	1.46	-1.689	0.103
	Failure group	1.00	2.33		

N-Ba (mm)	Success group	100.68	6.10	-0.698	0.491
	Failure group	102.24	5.70		
Li-H (mm)	Success group	-0.036	1.85	-2.180	0.038*
	Failure group	1.60	2.11		
Overjet (mm)	Success group	9.21	2.45	2.675	0.013*
	Failure group	7.13	1.56		
B-PG (mm)	Success group	6.18	1.33	1.799	0.084
	Failure group	5.39	0.98		
S-L (mm)	Success group	40.56	8.16	0.161	0.873
	Failure group	40.11	6.27		
Ar-Pg (mm)	Success group	94.59	5.64	-0.777	0.444
	Failure group	96.14	4.88		
PNS-Ba (mm)	Success group	42.81	3.30	0.293	0.772
	Failure group	42.42	3.66		
L6-MP (mm)	Success group	25.89	2.19	-2.633	0.014*
	Failure group	28.31	2.64		
L1-MP (mm)	Success group	37.29	2.68	-2.585	0.016*
	Failure group	39.86	2.60		
U6-PP (mm)	Success group	20.11	1.42	-1.549	0.134
	Failure group	21.24	2.31		
U1-PP (mm)	Success group	26.13	2.8	-1.457	0.157
	Failure group	27.64	2.7		
Co-Gn – Co-A (mm)	Success group	19.7	3.29	-0.669	0.509
	Failure group	20.49	2.97		
S-Go/N- Me (ratio)	Success group	64.33	3.52	0.738	0.467
	Failure group	63.31	3.75		
S-Ar/Ar- Go (ratio)	Success group	76.41	9.39	-1.376	0.181
	Failure group	80.8	7.39		
S-N/Go- Gn (ratio)	Success group	98.02	6.1	-0.838	0.41
	Failure group	100.35	8.43		

^a Independent samples t-test, * Statistically significant

Table 3. Comparison of variables with non-normal distribution

Variable	Group	Mean	Standard deviation	z	P ^a
FMA (°)	Success group	23.25	4.04	-1.930	0.054
	Failure group	27.03	4.32		
Interincisal angle	Success group	116.26	8.17	-0.873	0.382
	Failure group	117.25	6.83		
L1-NB (°)	Success group	27.76	7.85	-1.288	0.198
	Failure group	32.08	4.63		
FP-AB (°)	Success group	-13.26	3.61	-1.632	0.103
	Failure group	-10.76	2.21		
GO-GN (mm)	Success group	67.56	5.37	-0.253	0.800
	Failure group	68.16	5.36		
N-GO (mm)	Success group	106.57	5.42	-1.057	0.291
	Failure group	109.57	7.16		
N-ANS/ANS-Me (ratio)	Success group	0.84	0.076	-6.56	0.512
	Failure group	0.82	0.07		
Overbite (mm)	Success group	5.23	2.23	-1.890	0.059
	Failure group	4.14	1.93		
L1-NB/Pg-NB (ratio)	Success group	2.48	2.39	-3.355	0.001*
	Failure group	8.82	13.31		

^aMann-Whitney U test, * Statistically significant

Table 4. Discriminant values and classification success percentages in discriminant analysis

	Discriminant value	Categorisation ability of the success group (%)	Categorisation ability of the failure group (%)	Average categorisation ability for both groups (%)
U1SN (°)	107 (+)	57.1	64.3	60.7
U1PP (°)	116.5 (+)	50	64.3	57.1
U1NA (°)	26.7 (+)	71.4	85.7	78.6
FMIA (°)	55.5 (+)	64.3	64.3	64.3
ODFH (°)	4.7 (-)	71.4	57.1	64.3
Ls-B'-Pg' (°)	116.7 (-)	71.4	64.3	67.9
N-ME (mm)	110.1 (-)	78.6	64.3	71.45
L1-NB (mm)	6.2 (-)	78.6	71.4	75
Pg-NB (mm)	2.2 (+)	78.6	85.7	82.1
Li-H (mm)	0.82 (-)	78.6	57.1	67.9
Li-E (mm)	1 (-)	78.6	57.1	67.9
Overjet (mm)	8.2 (+)	64.3	71.4	67.9
L6-MP (mm)	27.1 (-)	64.3	64.3	64.3
L1-MP (mm)	38.56 (-)	71.4	64.3	67.9

Discussion

In this study, the ANB angle was used to classify treatment outcomes as successful or unsuccessful. A reduction of 3° or more in the angle was considered a success of functional therapy, and a reduction of 1° or less was considered unsuccessful. Cases with a reduction between 1° and 3° were not included in the study, as it would be difficult to determine whether this was a growth-related reduction or a success of functional treatment.

Just as there are studies using the ANB angle as a success criterion (14,15), there are also studies using different criteria (16,17). Patel et al have investigated the cephalometric determinants of successful functional appliance therapy and they have used ANB as a success criterion (14). Caldwell and Cook have investigated on predicting the outcome of twin block functional appliance treatment and they have used changes in overjet as a success criterion (17). In the present study, as overjet is a data that can change easily depending on the inclination of the incisors, we preferred to use the ANB angle, which is a more skeletal indicator.

In this study, both groups were created by patients who were at the pubertal peak period. The stage of growth and development was measured using the cervical vertebral maturation method (CVM). This method has been shown to be a reliable and reproducible method for determining the maturation level (18). Franchi and Baccetti have also used the same method in their studies, and included patients who were in the Stage 316. Although the growth-development period is a crucial factor in the success of the functional appliances, some studies have either ignored this issue or used chronological age, which is unreliable (15,19-21). We think that this situation makes these results contradictory.

Out of the seventy-five cephalometric variables analysed, the Independent Samples t-test revealed statistically significant differences in fourteen variables between the success and failure groups. Additionally, the Mann-Whitney U test showed statistically significant differences in one variable between the success and failure groups. Three of the variables that differed significantly (U1-SN(^o), U1-PP(^o) and U1-NA(^o)) were the angles related to the upper incision inclination and were found to be higher in the success group. Consistent with these data, the amount of initial overjet was also statistically higher in the success group (Table 2).

In some patients with Class II Division 1 malocclusion, the lower lip is posturally positioned on the palatal surface of the upper lip. In such cases, the lower lip pressure causes the upper incisors to protrude, the lower incisors to retrude, and the amount of overjet increases. Although the malposition of the lower lip is initially a consequence of the Class II Division 1 malocclusion, it worsens the situation over time and becomes the cause of the malocclusion. In these patients, the treatment is successful because the functional appliance also acts as a habit breaker and removes the obstacle to the forward growth of the mandible. It was also found that Li-E and Li-H distances were statistically lower in the success group. We think that these findings are also related to the habitual positioning of the lower lip behind the upper incisors in some patients and that it proves the accuracy of the hypothesis described above. In such patients, while the sagittal development of the mandible continues normally, the lower lip is positioned farther back than it should be because it is blocked by the upper incisors.

N-Me, L6-MP, and L1-MP distances and OP-FH were found to be statistically lower in the success group. All these measurements are related to the vertical growth pattern of the mandible. Functional treatment was found to be more successful in patients with a low angle

growth pattern and counter clockwise mandibular rotation. In a similar study which also aimed to investigate cephalometric determinants about successful functional appliance therapy by Patel et al., they reported that both the lower and upper anterior face pretreatment heights were lower in the successful group (14). The data obtained from the present study revealed that there was no difference between the two groups in terms of the sagittal size of the mandible, but there was a difference in the measurements related to the direction of growth. This suggests that the direction of growth, rather than the size of the lower jaw, is a factor in the success of the treatment. Interestingly, the classical cephalometric measurements used to evaluate the vertical growth pattern; Go-GN-SN and FMA angles, did not show any difference between the two groups. Wide variations in the location of sella and porion in the cranium may be the cause of this situation.

Although the sagittal size of the mandible was similar in both groups, the measurements of Pg-NB distance and Li-B'-Pg' angle revealed differences in the morphology of the symphysis between the two groups. It was found that the success group had a more pronounced chin prominence. According to the results of the present study, a prominent symphysis formation is a serious sign that the functional treatment will be successful.

Our study may be considered similar to the study by Patel et al. in some aspects. In their study, the researchers used three different functional appliances; medium opening activator, Twin Block and Frankel II. 28 patients were divided into two groups as successful and less successful. However, there is no data on how many of the 13 patients in the study were treated with which appliance. In addition, the medium opening activator, one of the three appliances used, is an appliance designed to allow the lower molars to elongate and is mainly used in skeletal class II patients with a deep bite. Although the Frankel II is a functional appliance, it has a different working principle. It reorganises the muscle activity that determines the position and function of the mandible. This creates pressure from the muscles and surrounding soft tissues onto the hard tissues, and the redirection of the forces created by the appliance reshapes the form and function of the retruded mandible. In the present study, both the success and failure groups were treated with the same appliance, allowing a much more consistent interpretation of the results obtained.

Conclusions

This study was carried out in order to determine the cephalometric variables that can be used to predict the treatment success in patients treated with the Twin Block appliance. Of the seventy-five cephalometric measurements investigated, fifteen measurements showed significant differences between the groups. The correct classification rates of these variables were calculated for each variable, and it was observed to be in the range of 82.1% (Pg-NB) to 57.1% (U1-PP").

The highest correct classification success belonged to Pg-NB (mm) (82.1%). It showed that the tip of chin was more pronounced in the success group.

The success group had a higher value of U1NA (°) and a lower value of L1-NB (mm) than the failure group. Prediction success percentages were 78.6% and 75%, respectively.

The value of the N-Me (mm) was lower in the success group.

This study showed that patients with a prominent chin tip, protrusive upper incisors, retrusive lower incisors, and lower anterior face height were more likely to be successfully treated with the Twin Block appliance.

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