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Evaluation of accuracy for prediction of soft tissue profile changes in non-growing patients undergoing orthodontic treatment using cephalometric android application

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Abstract

INTRODUCTION: An accurate prediction in soft tissue changes is of great importance for orthodontic treatment planning. Patients find it difficult to imagine how their facial appearance may change after orthodontic treatment without a visual reference. Predicting the postoperative facial appearance may thus be useful for managing expectations, easing communication, and researching different treatment choices. Computer-assisted programs are still relatively expensive and are not portable in comparison to smartphones, and the accuracy of soft tissue profile prediction of these android applications has not been thoroughly assessed. The purpose of the study is to assess how well the Webceph cephalometric Android application predicts changes in soft tissue profile following orthodontic treatment.
MATERIALS AND METHOD: A total of 50 patients were screened for eligibility, and 24 young adult patients (8 males, 16 females; mean age 24.8 ±3.9 years) were finally included in the study based on the inclusion and exclusion criteria. The landmarks and parameters of the Legan and Burstone soft tissue analysis were used for the cephalometric analyses. The cephalometric tracings of the actual treatment result and the Webceph predicted treatment outcome was superimposed to calculate the prediction errors. Paired t-test used to compare the statistical differences between the predicted and actual treatment outcomes of the parameters used in the legan and burstone soft tissue analysis.
RESULTS: There were significant differences between the predicted and actual values in parameters of legan and burstone soft tissue analysis (P\0.05). It was reported that the prediction in two parameters (i.e., Lower face throat (Sn-Gn-C angle) (Cm-sn-ls) Nasolabial angle) was a significant difference from the actual modifications in class I bimaxillary protrusion group and there were substantial changes in the prediction of two characteristics (facial convexity (G-Sn-Pg angle) and inter labial (Stms-Stmi) in the class II group.
CONCLUSIONS: The Webceph VTO prediction in soft tissue changes after the orthodontic treatment in patients with bimaxillary protrusion and class II malocclusion is the most accurate for the nasolabial angle and the least accurate for the mandibular prognathism parameter.

Keywords: Webceph cephalometric software, soft tissue prediction, VTO prediction, class I malocclusion, class II malocclusion

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1. Introduction

Modern orthodontics places a considerable therapeutic emphasis on improving facial aesthetics, making it one of the most frequent reasons patients seek orthodontic treatment today. The soft tissues of the face are crucial to facial attractiveness. As a result, most orthodontists think that enhancing the soft tissue profile has a direct relationship to the outcome of orthodontic therapy[7].

The ability to accurately predict soft tissue changes is critical for orthodontic treatment planning. Patients find it difficult to imagine how their facial appearance may change after orthodontic treatment without a visual reference. Predicting the postoperative facial appearance may thus be useful for managing expectations, easing communication, and researching different treatment choices. Improvements in facial look and soft tissue profile are the main reasons of orthodontic treatment for class I and class II malocclusion patients, which often entails the extraction of first or 2nd premolars and the retraction of the anterior and lips.[12] Orthognathic surgery or selective removal of permanent teeth are frequently used as treatments for Class II malocclusions in non-growing patients, with later dental camouflage to cover the skeletal discrepancy. Although the underlying sagittal jaw difference was not considered in the current investigation, selective extraction of permanent teeth was judged to be acceptable because neither the patients nor their families preferred a surgical approach to therapy. [3]

Schendel, Eisenfeld, Bell, and Epker were among the first to use a computer system to examine preoperative and postoperative soft tissue profiles[10]. As a result, computer-aided diagnostic and treatment planning has recently received a lot of attention as a method of anticipating orthodontic treatment outcomes. Dentofacial Planner Plus (Dentofacial Software, Toronto, Ontario, Canada) (DFP), Quick Ceph (Quick Ceph Systems, San Diego, Calif.), webceph, Orthognathic Treatment Planner (GAC International, Birmingham, Ala), and Dolphin Imaging are among the computer tools available today for such planning and predicting the soft tissue outcome after surgical intervention.[11]

Orthodontic clinicians use a variety of cephalometric software during clinical consultation and treatment planning to visualise and forecast the outcomes of orthodontic treatment and the soft tissue profile. Treatment needs are frequently tied to aesthetic and psychological considerations rather than functional ones. Even though it occurs frequently, treatment options should be based on solid scientific evidence rather than intuition.

The efficiency and effectiveness of doctor-patient communication has been greatly improved using several cephalometric Android applications to forecast orthodontic treatment outcomes and soft tissue profiles.[2] Computer-assisted programs are still relatively expensive and are not portable in comparison to smartphones, and the accuracy of soft tissue profile prediction of these android applications has not been thoroughly assessed. Most of the present literature focuses on hard tissue changes, and very few have attempted to determine the accuracy of a soft tissue profile change; we discovered no study evaluating the prediction module of the webceph cephalometric android application.

The purpose of the study is to assess how well the Webceph cephalometric Android application predicts changes in soft tissue profile following orthodontic treatment. The objective is to examine actual and expected changes in soft tissue profiles using the webceph cephalometric android application.

3. Material and Methods

A retrospective observational design was used to design the study. The eligibility of 50 patients from the Dr. D. Y. Patil Dental College and Hospital, Pimpri, Pune, was screened. Based on a prior study, the sample size was calculated with type I error set at 0.05 and type II error set at 0.20 (80% power). 24 young adult patients (8 males, 16 females) were included in the study after applying the inclusion and exclusion criteria to account for potential dropouts during the trial.

Inclusion criteria were, nongrowing young adult patients (aged 18-40 years, cervical vertebral maturation stage 5), skeletal Class I, angle Class I bimaxillary dental protrusion malocclusion, and skeletal and dental class II malocclusion, Patients who underwent extraction for orthodontic treatment, Pretreatment and posttreatment lateral cephalometric radiographs of good quality and profile photos of the same patient. And Exclusion Criteria include Patients with the presence of any abnormal morphology or craniofacial deformities, Congenital missing anterior teeth, and Radiographs with artifacts.

Prior permission was obtained from Dr. D. Y. Patil Dental College and Hospital to conduct the study. Every patient who satisfies the inclusion criteria was selected. The study was done in the Department of Orthodontics and Dentofacial Orthopaedics at Dr. D. Y. Patil Dental College and Hospital. The identical cephalostat was used for all cephalometric radiographs, which were all taken with the patient's head in its natural posture, the lips slightly pursed, and the teeth in centric occlusion. Pretreatment and posttreatment digital lateral cephalograms of patients who have undergone orthodontic treatment in the department of orthodontics and dentofacial orthopaedics in Dr. D. Y. Patil Dental College and Hospital were taken. Cephalometric tracing, analysis, and VTO prediction were performed using Webceph cephalometric Android program Version: 1.5.0. Each participant's profile photo and pre- and (webceph) posttreatment cephalometric radiographs were imported, and AI digitization was done for tracing and superimposed using the Frankfort plane as the reference plane (Figure 1,2,3,4). Standardization of the radiographs was automatically done by AI digitization. webceph was used for cephalometric tracing and analysis (Figure 3,4). To produce a VTO-predicted treatment outcome, the actual changes of the maxillary and mandibular incisors before and after the treatment, along with the horizontal displacement distances (mm), were calculated and subsequently input into the Webceph cephalometric android Software Version: 1.5.0. With the help of the Webceph cephalometric Android Software Version: 1.5.0 measurement function, the values of soft tissue changes (legan and burstone soft tissue parameters) of the actual posttreatment and the VTO projected treatment outcomes were automatically recorded (Figure 5).

To create the cephalometric superimposition that illustrates the difference between the actual changes and the VTO-predicted results, the cephalometric tracing of the VTO-predicted profile was superimposed with the actual posttreatment cephalometric tracing (Figure 6).

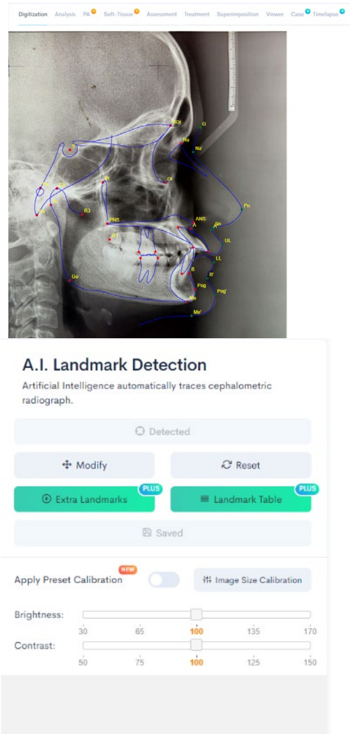

Figure 1. Tracing of Pretreatment Lateral Cephalogram

The values of soft tissue changes of the actual posttreatment and the VTO predicted treatment outcomes will automatically be recorded using the android application. The cephalometric tracing of the VTO-predicted profile will be superimposed with the actual posttreatment cephalometric tracing to generate the cephalometric superimposition showing the difference between the actual changes and the VTO-predicted results. The intraclass correlation coefficients were used to test the intraoperator and interoperator reliabilities. Two independent dental investigators randomly chose six cephalometric radiographs to retrace. After four weeks, each researcher repeated the measurements. Excellent inter-rater reliability was demonstrated (the correlation coefficient was 0.99). Excellent interrater reliability was achieved (correlation coefficients for the 2 investigators were 0.95 and 0.99). The study design was hidden from the statistician, the two researchers, and each other.

The following parameters will be used to check the soft tissue profile changes.

- Facial convexity (G-Sn-Pg angle)
- Maxillary prognathism (G-Sn)
- Mandibular prognathism (G-Pg)
- Vertical height ratio (G-Sn/Sn-Me)
- Lower face throat (Sn-Gn-C angle)
- Lower vertical height depth ratio (Sn-Gn/C-Gn)
- Nasolabial angle (Cm-sn-ls)
- Upper lip protrusion (Ls to Sn-Pg)
- Lower lip protrusion (Li to Sn-Pg)
- Mentolabial sulcus depth
- Vertical lip chin ratio (Sn-Stms/stmi-Me)
- Maxillary incisor exposure
- Interlabial gap (Stms-Stmi)

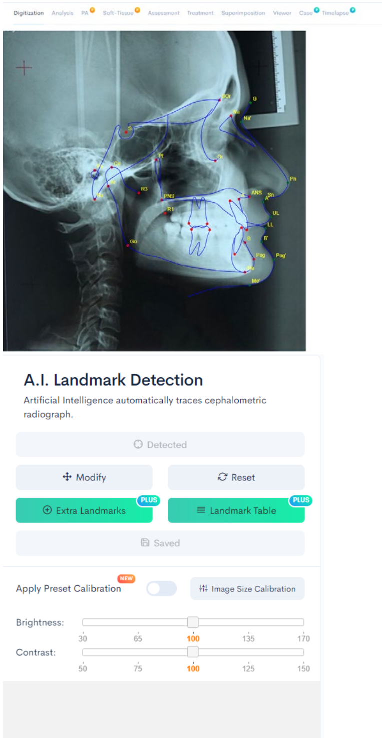

Figure 2. Posttreatment Tracing of Lateral Cephalogram

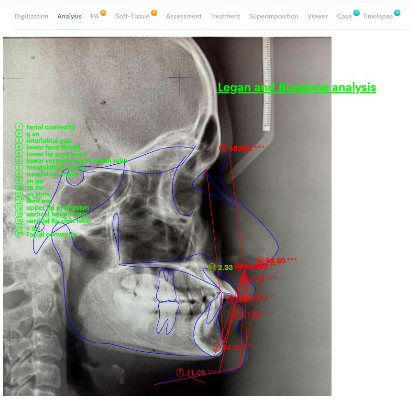

Figure 3. Pretreatment Analysis

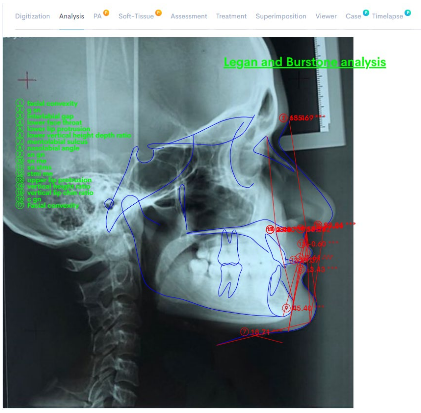

Figure 4. Posttreatment Analysis

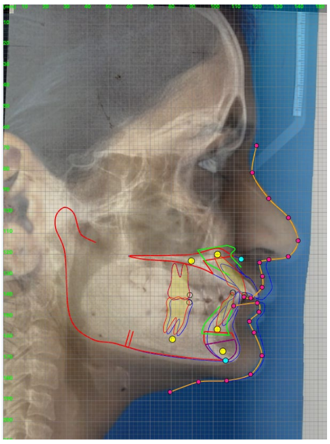

Figure 5. VTO Prediction

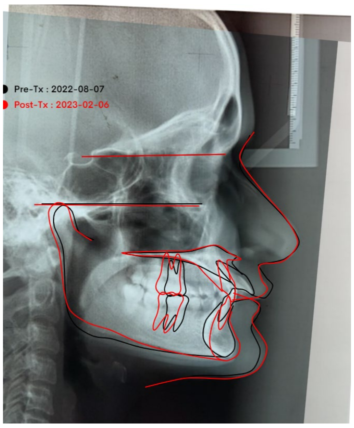

Figure 6. Superimposition

4. Results

It was reported that the prediction in two parameters (i.e., Lower face throat (Sn-Gn-C angle) (Cm-sn-ls) Nasolabial angle) was a significant difference from the actual modifications in the class 1 bimaxillary protrusion group out of a total of 13 parameters (Table 1). Furthermore, there were substantial changes in the prediction of two characteristics (facial convexity (G-Sn-Pg angle) and interlabial gap (Stms-Stmi)) in the class 2 group (Table 2).

When the mean difference between Actual and Prediction values for Class I and Class II is compared, the nasolabial angle and upper lip protrusion reveal a significant difference (Table 3). When the mean difference between the actual value and the predicted value for Class I and Class II is compared, the nasolabial angle accuracy percentage for Class I and Class II is 90% and 96%, respectively, which is a more accurate percentage, whereas the mandibular prognathism parameter accuracy percentage for Class I and Class II is 39% and 50%, respectively, which is the least accurate for the webceph cephalometric Android application (Table 4). Upper lip protrusion was 66% and 78% for classes I and II, respectively, and lower lip protrusion was 90% and 84% for classes I and II (Table 4). When the mean difference between Actual and Prediction values for Class I and Class II is compared, the nasolabial angle and upper lip protrusion reveal a significant difference (See Table 3).

Class I		Mean	Diff	N	SD	SE	t-Value	P-Value	Remark
Facial convexity (G-Sn-Pg angle)	Post	16.500	0.250	12	4.964	1.433	0.225	0.826	NS
	Prediction	16.250		12	7.724	2.230			
Maxillary prognathism (G-Sn)	Post	9.817	0.233	12	4.487	1.295	0.195	0.849	NS
	Prediction	9.583		12	3.051	0.881			
Mandibular prognathism (G-Pg)	Post	-2.925	0.117	12	6.646	1.919	-0.060	0.953	NS
	Prediction	-2.808		12	6.854	1.979			
Vertical height ratio (G-Sn/Sn-Me)	Post	0.950	0.050	12	0.173	0.050	1.254	0.236	NS
	Prediction	0.900		12	0.104	0.030			
Lower face throat (Sn-Gn-C angle)	Post	106.817	7.292	12	8.282	2.391	2.212	0.049	Sig
	Prediction	99.525		12	8.312	2.399			
Lower vertical height depth ratio (Sn-Gn/C-Gn)	Post	1.458	0.000	12	0.239	0.069	0.000	1.000	NS
	Prediction	1.458		12	0.231	0.067			
Nasolabial angle (Cm-sn-ls)	Post	109.333	7.308	12	10.491	3.028	2.758	0.019	Sig
	Prediction	102.025		12	11.615	3.353			
Upper lip protrusion (Ls to Sn-Pg)	Post	2.642	0.517	12	1.000	0.289	-1.158	0.272	NS
	Prediction	3.158		12	1.174	0.339			
Lower lip protrusion (Li to Sn-Pg)	Post	-2.933	0.350	12	2.801	0.809	-0.968	0.354	NS
	Prediction	-2.583		12	3.589	1.036			
Mentolabial sulcus depth	Post	-3.425	0.083	12	1.188	0.343	0.373	0.716	NS
	Prediction	-3.508		12	1.690	0.488			
Maxillary incisor exposure	Post	3.400	0.117	12	1.501	0.433	-0.512	0.619	NS
	Prediction	3.517		12	1.447	0.418			
Interlabial gap (Stms-Stmi)	Post	2.700	0.017	12	1.772	0.512	-0.070	0.945	NS
	Prediction	2.717		12	1.711	0.494			
Vertical lip chin ratio (Sn-Stms/stmi-Me)	Post	3.617	0.025	12	14.229	4.108	1.000	0.339	NS
	Prediction	3.592		12	14.237	4.110			

Table 1. Intragroup Comparison (Post-Predicted) for Class I

Paired t-test is carried out for comparison of post and predicted mean value of class I observations. Above table shows the result for paired t-test. P-Value less than 0.05 considered as significant difference between post -treatment mean and predicted mean and non-significant if P-Value is greater than 0.05.

Table 2. Intragroup Comparison (Post-Predicted) for Class II

Class II		Mean	Diff	N	SD	SE	t-Value	P-Value	Remark
Facial convexity (G-Sn-Pg angle)	Post	17.833	2.000	12	8.100	2.338	-2.746	0.019	Sig
	Prediction	19.833		12	8.386	2.421			
Maxillary prognathism (G-Sn)	Post	9.867	0.817	12	4.972	1.435	-0.887	0.394	NS
	Prediction	10.683		12	3.613	1.043			
Mandibular prognathism (G-Pg)	Post	-5.983	0.358	12	8.583	2.478	0.168	0.869	NS
	Prediction	-6.342		12	7.038	2.032			
Vertical height ratio (G-Sn/Sn-Me)	Post	1.067	0.000	12	0.123	0.036	0.000	1.000	NS
	Prediction	1.067		12	0.150	0.043			
Lower face throat (Sn-Gn-C angle)	Post	106.250	4.583	12	6.744	1.947	-1.743	0.109	NS
	Prediction	110.833		12	7.095	2.048			
Lower vertical height depth ratio (Sn-Gn/C-Gn)	Post	1.292	0.058	12	0.144	0.042	1.400	0.189	NS
	Prediction	1.233		12	0.235	0.068			
Nasolabial angle (Cm-sn-ls)	Post	109.750	0.333	12	15.978	4.612	0.248	0.809	NS
	Prediction	109.417		12	14.755	4.259			
Upper lip protrusion (Ls to Sn-Pg)	Post	2.567	0.100	12	1.373	0.396	-0.502	0.626	NS
	Prediction	2.667		12	1.413	0.408			
Lower lip protrusion (Li to Sn-Pg)	Post	-1.742	0.783	12	3.469	1.001	1.711	0.115	NS
	Prediction	-2.525		12	4.046	1.168			
Mentolabial sulcus depth	Post	-4.125	0.208	12	1.043	0.301	-0.911	0.382	NS
	Prediction	-3.917		12	1.075	0.310			
Maxillary incisor exposure	Post	3.650	1.125	12	1.346	0.389	1.610	0.136	NS
	Prediction	2.525		12	2.295	0.662			
Interlabial gap (Stms-Stmi)	Post	2.075	0.258	12	0.776	0.224	3.684	0.004	Sig
	Prediction	1.817		12	0.751	0.217			
Vertical lip chin ratio (Sn-Stms/stmi-Me)	Post	3.092	0.292	12	12.379	3.574	-1.000	0.339	NS
	Prediction	3.383		12	13.389	3.865			

Paired t-test is carried out for comparison of post and predicted mean value of class II observations. Above table shows the result for paired t-test. P-Value less than 0.05 considered as significant difference between posttreatment mean and predicted mean and non-significant if P-Value is greater than 0.05.

Table 3. Comparison of mean difference of Actual and Prediction value for Class I and Class II

Variable	Class	N	Mean Diff	SD	SE	t-Value	P-Value	Remark
Facial convexity (G-Sn-Pg angle)	Class I	12	3.083	2.109	0.609	0.855	0.402	NS
	Class II	12	2.333	2.188	0.632			
Maxillary prognathism (G-Sn)	Class I	12	3.333	2.269	0.655	1.102	0.282	NS
	Class II	12	2.317	2.249	0.649			
Mandibular prognathism (G-Pg)	Class I	12	5.783	2.890	0.834	0.028	0.978	NS
	Class II	12	5.742	4.316	1.246			
Vertical height ratio (G-Sn/Sn-Me)	Class I	12	0.100	0.104	0.030	2.000	0.058	NS
	Class II	12	0.033	0.049	0.014			
Lower face throat (Sn-Gn-C angle)	Class I	12	11.792	6.058	1.749	1.740	0.096	NS
	Class II	12	7.083	7.154	2.065			
Lower vertical height depth ratio (Sn-Gn/C-Gn)	Class I	12	0.067	0.107	0.031	-0.528	0.603	NS
	Class II	12	0.092	0.124	0.036			
Nasolabial angle (Cm-sn-ls)	Class I	12	10.475	4.777	1.379	4.311	0.000	Sig
	Class II	12	4.167	1.697	0.490			
Upper lip protrusion (Ls to Sn-Pg)	Class I	12	1.233	1.011	0.292	2.145	0.043	Sig
	Class II	12	0.567	0.370	0.107			
Lower lip protrusion (Li to Sn-Pg)	Class I	12	0.567	1.163	0.336	-0.705	0.488	NS
	Class II	12	0.950	1.483	0.428			
Mentolabial sulcus depth	Class I	12	0.567	0.507	0.146	-0.284	0.779	NS
	Class II	12	0.625	0.499	0.144			
Maxillary incisor exposure	Class I	12	0.500	0.605	0.175	-0.974	0.341	NS
	Class II	12	1.192	2.385	0.689			
Interlabial gap (Stms-Stmi)	Class I	12	0.550	0.592	0.171	1.580	0.128	NS
	Class II	12	0.258	0.243	0.070			
Vertical lip chin ratio (Sn-Stms/stmi-Me)	Class I	12	0.025	0.087	0.025	-0.911	0.372	NS
	Class II	12	0.292	1.010	0.292			

Unpaired t-test is carried out for comparison of mean difference between actual value and prediction value for Class I and Class II. Above table shows the result for unpaired t-test. P-Value less than 0.05 considered as significant difference between Class I and Class II mean difference.

Table 4. Comparison of mean accuracy percentage for Class I and Class II

Variable	Class	N	Mean % Accuracy	SD	SE	t-Value	P-Value	Remark
Facial convexity (G-Sn-Pg angle)	Class I	12	80.148	16.575	4.785	-0.797	0.434	NS
	Class II	12	85.834	18.344	5.295			
Maxillary prognathism (G-Sn)	Class I	12	71.819	16.731	4.830	-1.270	0.217	NS
	Class II	12	80.830	18.009	5.199			
Mandibular prognathism (G-Pg)	Class I	12	39.174	24.926	7.196	-0.955	0.350	NS
	Class II	12	50.016	30.426	8.783			
Vertical height ratio (G-Sn/Sn-Me)	Class I	12	89.585	11.636	3.359	-2.037	0.054	NS
	Class II	12	96.935	4.563	1.317			
Lower face throat (Sn-Gn-C angle)	Class I	12	89.315	5.292	1.528	-1.996	0.058	NS
	Class II	12	93.900	5.943	1.716			
Lower vertical height depth ratio (Sn-Gn/C-Gn)	Class I	12	96.019	6.276	1.812	0.874	0.392	NS
	Class II	12	93.105	9.694	2.798			
Nasolabial angle (Cm-sn-ls)	Class I	12	90.569	4.239	1.224	-4.210	0.000	Sig
	Class II	12	96.120	1.703	0.492			
Upper lip protrusion (Ls to Sn-Pg)	Class I	12	66.105	23.928	6.907	-1.503	0.147	NS
	Class II	12	78.672	16.321	4.711			
Lower lip protrusion (Li to Sn-Pg)	Class I	12	90.014	17.552	5.067	0.726	0.476	NS
	Class II	12	84.196	21.529	6.215			
Mentolabial sulcus depth	Class I	12	83.749	17.773	5.131	-0.181	0.858	NS
	Class II	12	84.854	11.533	3.329			
	Class I	12	85.246	18.377	5.305	-0.339	0.738	NS

Maxillary incisor exposure	Class II	12	87.660	16.485	4.759			
Interlabial gap (Stms-Stmi)	Class I	12	78.712	21.333	6.158	-1.196	0.244	NS
	Class II	12	87.078	11.501	3.320			
Vertical lip chin ratio (Sn-Stms/stmi-Me)	Class I	12	96.429	12.372	3.571	-0.809	0.427	NS
	Class II	12	99.365	2.201	0.635			

Unpaired t-test is carried out for comparison of mean accuracy percentage for Class I and Class II. Above table shows the result for unpaired t-test. P-Value less than 0.05 considered as significant difference between Class I and Class II mean accuracy percentage.

5. Discussion

The ability to accurately forecast soft tissue changes is critical for orthodontic treatment planning. Computer-assisted programmes are still very expensive and immobile in compared to smartphones; also, the accuracy of soft tissue profile prediction of these Android applications has not been properly evaluated. The current study evaluated the reliability of the webceph cephalometric Android application VTO in predicting the treatment outcome of soft tissue reactions to orthodontic treatments in individuals with class I and class II malocclusion. According to Behrents,[5] face development can be witnessed all the way up to adulthood. According to Bishara et al.,[5] the most significant soft tissue changes in females are expected to occur between the ages of 10 and 15. Soft tissue alterations will be completed following menarche.[5] As a result, we chose an adult patient who was at least 18 years old at the start of therapy, resulting limiting the effects of growth and ethnicity.

Planning orthodontic therapy requires careful prediction of soft tissue alterations. In the current study, patients with bimaxillary protrusion and class II malocclusion were examined for the webceph VTO's accuracy in predicting the treatment outcome of soft tissue reactions to orthodontic treatment. It was reported that the prediction in 2 parameters (i.e., Lower face throat (Sn-Gn-C angle) (Cm-sn-ls) Nasolabial angle) was a significant difference from the actual alterations in class I bimaxillary protrusion group. Additionally, the prediction in 2 characteristics (such as facial convexity (G-Sn-Pg angle) Interlabial gap (Stms-Stmi)) were significant changes in the class II group.

The responses of both soft and hard tissues to orthognathic treatment were the focus of prior research on the accuracy and reliability of the Dolphin VTO in predicting treatment outcomes (with or without orthodontic treatment). It was discovered that the Dolphin VTO was acceptably accurate in forecasting the alterations of the face angle, SNA, and SNB hard tissue landmarks. Most studies found that the subnasale and lips were the least accurately anticipated landmarks following orthognathic treatment, while the tip of the nose was the most consistently predicted landmark in terms of soft tissue changes. It is currently unknown, nevertheless, how well Dolphin VTO predicts soft tissue alterations during orthodontic treatment. [7]

The Dolphin VTO did not exhibit a directional bias in the prediction, according to several research on orthognathic treatment (with or without orthodontic treatment). The only important metrics for the webceph cephalometric Android application are the nasolabial angle and upper lip protrusion, according to a comparison of the mean difference between the actual value and predicted value for Class I and Class II.[7]

In upper lip protrusion (Sls) retraction, 60% of the variability was accounted for by Brock et al.[5] Pretreatment upper lip thickness and prosthion horizontal movement were reported to be significant predictor factors by Talass et al.[5] and Ramos et al.[5] The lower lip retraction multivariable prediction equation was able to account for 91% of the variability. The lower lip retracted similarly to the upper lip, which contradicts reports that the upper lip retracted less predictably due to the upper lip's intricate architecture. Our study shows almost similar results that for upper lip protrusion (retraction), it was 66% and 78% for class I and class II groups and for lower lip protrusion(retraction) it was 90% and 84% for class I and class II groups However, Amin Shirvani's[5] research found that there may not be much of a difference between the upper and lower lips. According to research by Veltkamp et al[5]., only around 50% of the diversity in soft tissue response can be described by utilising basic ratios.

Dolphin imaging software, according to Xu Zhang et al.[7], tended to overestimate horizontally and underestimate vertically the landmarks in the region of the lips (i.e., the subnasale, soft tissue A-point, upper lip, lower lip, and soft tissue B-point), while the landmarks in the chin region (i.e., the soft tissue pogonion, soft tissue gnathion, and soft tissue menton) tended to be the opposite The forecast was most accurately generated by the soft tissue next to the A-point, whereas it was least accurate by the soft tissue under the chin. According to Andrew Hodges et al.[12], white female adolescents and adults can predict upper and lower lip retraction in four first premolar extraction instances with moderately high levels of accuracy using the image software Viewbox (dHAL, Kifissia, Greece).but in our study with four premolar extraction cases for class I and class II malocclusion the high level of accuracy was seen for nasolabial angle and for upper and lower lip protrusion the high level accuracy is for lower lip protrusion than upper lip protrusion.

The nose tip, soft tissue A point, and upper lip displayed the least predicted errors in the sagittal plane, according to Chien-Hsun Lu et al.[8] The nasal tip, however, displayed higher consistency. The lower lip region that predicted positions the least accurately was found to be anterior to the actual position. For the patients who had orthognathic surgery, most of the predictions showed more accuracy in the vertical plane than in the sagittal plane. Almurtadha et al[2]. demonstrated a considerable retraction of the lips and an increase in NLA are related to extraction techniques; however, the degree to which these alterations affect the profile varies under several circumstances. As a result, it is extremely difficult to forecast NLA variations following extraction. In the study by Pranali

Patel et al,[1] the mean value difference for NLA was -1.1°, which was within the range considered clinically acceptable. The accuracy of the NLA prediction using DIS was discovered. The accuracy of nasolabial angle prediction using DIS following teeth extractions has not been examined in any prior investigations. Additionally, our study demonstrates higher nasolabial angle accuracy rates in Class I and Class II malocclusion cases. The mean value difference for NLA in Class I patients is 7.3, whereas it is 0.33 in Class II patients. When Magro-Filho et al1,9. compared the DIS and the Dentofacial Planner software, they found that the latter was more accurate at predicting NLA than the former. However, Class III cases were included in this study, not just dental extractions, but also double jaw orthognathic surgery. The landmarks in the lip's region—the subnasale, soft tissue A-point, upper lip, lower lip, and soft tissue B-point—were predicted more accurately, but the landmarks in the chin region—the soft tissue pogonion, soft tissue gnathion, and soft tissue menton—were predicted less accurately. The subnasale or nasolabial angle provided the most accurate forecast, whereas the soft tissue beneath the chin or mandibular prognathism provided the least accurate. When the mean difference between the actual value and the predicted value for Class I and Class II is compared, the nasolabial angle accuracy percentage is 90 and 96%, respectively, which is a more accurate percentage, whereas the mandibular prognathism parameter accuracy percentage for Class I and Class II is 39 and 50%, respectively, which is the least accurate for the webceph cephalometric Android application. Upper lip protrusion was 66% and 78% for classes I and II, respectively, and lower lip protrusion was 90% and 84% for classes I and II. When the mean difference between Actual and Prediction values for Class I and Class II is compared, the nasolabial angle and upper lip protrusion reveal a significant difference. Brock et al., Talass et al., and Ramos et al. [5] obtain the same upper and lower lip prediction results as our study.

Our study had a few shortcomings, including a nonhomogeneous research sample and a lack of control over the impact of treatment variables such as the space closure method. Future studies could make use of 3D imaging techniques and a larger sample size, as well as more uniform pretreatment features and more closely controlled treatment variables.

6. Conclusion

For specific criteria, the webceph cephalometric android application VTO prediction in soft tissue changes after orthodontic treatment in patients with class I and class II malocclusion may differ significantly from the actual treatment result. Predicting the nasolabial angle is the most accurate while predicting soft tissue in the chin region is the least accurate. Upper lip protrusion was 66% and 78% in class I and class II groups, respectively, and lower lip protrusion was 90% and 84% in class I and class II groups. Predicting the soft tissue changes could be accomplished by using webceph cephalometric android application which is easy to handle and for better communication between patient and doctor.

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