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Facial and Profile Changes After Orthodontic Retraction of Anterior Teeth in First Bicuspid Extraction Cases

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ABSTRACT

Facial esthetics play a crucial role in orthodontics, where patients often evaluate treatment success by visible changes in their soft tissue profile. Bimaxillary protrusion, common in South Asian populations, is typically managed through extraction of four first premolars followed by anterior retraction. This retrospective observational study evaluated skeletal, dental, and soft tissue changes in 40 Class I Indian patients (mean age: 18.7 ± 2.3 years) treated with MBT fixed appliances after first premolar extractions. Pre- and post-treatment cephalograms were analyzed for skeletal (SNA, SNB, ANB), dental (1-NA, 1-NB, IMPA, 1-SN), and soft tissue parameters (lip position to TVL, nasolabial and labiomental angles, interlabial gap, soft tissue thickness). Results revealed significant upper and lower incisor retraction ($p < 0.001$), accompanied by notable soft tissue improvements: upper and lower lips retruded by ~3.3 mm, nasolabial angle increased by ~14°, labiomental angle improved by ~7°, and chin projection enhanced. Strong correlations were found between incisor retraction and lip response ($r = 0.78–0.81$), highlighting the predictability of soft tissue changes with dental movements. The findings confirm that extraction-based therapy in Class I bimaxillary protrusion yields favorable and esthetically balanced soft tissue outcomes. This study underscores the importance of incorporating soft tissue considerations into orthodontic treatment planning, particularly for Indian populations with distinct esthetic norms.

Keywords: *Orthodontics, Bimaxillary protrusion, Premolar extraction, Soft tissue profile, Lip retraction, Cephalometric analysis, Esthetics*

1. INTRODUCTION

Facial esthetics play a pivotal role in influencing an individual's social interactions, self-confidence, and psychological health. In orthodontic practice, the quest for a pleasing appearance largely centers around achieving balance and proportion in the soft tissue structures of the face, particularly the lips, nose, and chin. While correcting skeletal and dental irregularities remains a core objective, patients often judge treatment success by visible changes in their facial profile—highlighting the importance of soft tissue evaluation during diagnosis and planning.[1-3]

Bimaxillary protrusion, marked by forward-positioned lips and a convex profile, is a prevalent concern among many ethnic populations, notably South Asians. Within the Indian context, esthetic preferences often lean toward a flatter lip posture and more defined nasolabial and labiomental angles, prompting the frequent use of extraction-based orthodontic strategies to optimize facial harmony.[5-8]

A common approach for managing bimaxillary protrusion is the extraction of all four first premolars, facilitating the retraction of anterior teeth and, consequently, refinement of the soft tissue profile. However, the degree of soft tissue response to dental retraction varies significantly due to multiple factors such as lip thickness, muscle tone, incisor inclination, and age. Hence, it becomes essential to analyze these changes within specific population groups for better functional and esthetic outcomes.[9-12]

Charles Tweed, a pioneer in orthodontics during the 1940s, was among the first to advocate for premolar extraction as a means to improve not just dental alignment but overall facial esthetics. The technique remains a mainstay, particularly in patients presenting with bimaxillary protrusion, where it enables systematic retraction of the anterior dentition.[13-15]

The impact of this anterior retraction on soft tissues—especially lip and chin positioning—is of clinical significance. While skeletal and dental outcomes are readily quantifiable, predicting soft tissue adaptation is more complex and influenced by variables like lip tension, vertical proportions, and patient age. Existing studies have reported diverse ratios (ranging from 0.4:1 to 1.0:1) between lip retraction and incisor movement, though these metrics often vary depending on ethnicity and individual anatomy.[16-18]

Although substantial literature exists regarding the skeletal and dental consequences of extraction therapy, detailed evaluations of soft tissue transformations—particularly in Indian patients—are still limited. This knowledge gap creates challenges in meeting the esthetic expectations of patients who increasingly seek visible improvement in facial balance along with proper occlusion.[19-20]

The present study focuses on evaluating soft tissue profile modifications in skeletal and dental Class I Indian individuals treated with fixed appliances following extraction of four first premolars. By comparing pre- and post-treatment cephalometric soft tissue parameters with population-specific normative data, the research aims to provide a foundation for more predictable esthetic treatment planning.

The aim of this study was to evaluate the nature and extent of soft tissue profile alterations, with particular focus on lip posture, angular measurements such as the nasolabial and labiomental angles, and chin prominence, following extraction-based orthodontic therapy in Class I malocclusion cases. Specifically, the objectives were to assess changes in skeletal parameters (SNA, SNB, ANB) and dental inclinations (1-NA, 1-NB, IMPA, 1-SN) before and after retraction, to quantify modifications in soft tissue metrics including TVL-A', TVL-B', TVL-Pog', lip-to-TVL distances, interlabial gap, nasolabial and labiomental angles, and soft tissue thickness at A' and Pog', and to compare post-treatment outcomes with normative Indian cephalometric values. Additionally, the study aimed to establish correlations between the degree of incisor retraction and the magnitude of soft tissue changes in order to enhance predictability and improve clinical decision-making in orthodontic treatment planning.

2. MATERIALS AND METHODS

Study Design and Setting:

This retrospective observational study was conducted at the Department of Orthodontics and Dentofacial Orthopedics, D.Y. Patil School of Dentistry, Navi Mumbai. Ethical clearance was obtained under protocol number DYPU/OD/2018/045.

Sample Selection:

A total of 40 subjects (22 females and 18 males), aged 17–25 years (mean age: 18.7 ± 2.3), were selected from treated cases between 2015 and 2020. Inclusion criteria were:

Class I skeletal and dental relationships

Pronounced proclination of anterior teeth

Treatment involving extraction of all four first premolars

Use of 0.022" MBT fixed appliances

Availability of high-quality pre-retraction (T1) and post-retraction (T2) lateral cephalograms

Exclusion criteria involved history of prior orthodontic intervention, congenital anomalies, missing teeth (excluding third molars), facial asymmetry, or incomplete records.

Cephalometric Protocol

Standardized digital lateral cephalograms were taken using XTROPAN 2000 and KODAK CR 7400 systems, with a maintained magnification ratio of 1:1. Radiographs were captured with the patient in natural head position, lips relaxed, and teeth in centric occlusion. Images were saved as DICOM files and printed for manual tracing.

Tracings were conducted by two trained orthodontists using acetate overlays and 3HB pencils on an illuminated viewbox. Any measurements differing by more than 0.5 mm or 1° were reassessed collaboratively. Inter-rater reliability was confirmed with an intraclass correlation coefficient (ICC) exceeding 0.90.

Cephalometric Landmarks and Measurements

Skeletal Points:

Sella (S)

Nasion (N)

Point A

Point B

Pogonion (Pog)

Dental Points:

Upper and lower incisor tips/apices

Reference lines: N-A, N-B, mandibular plane, and S-N plane

Soft Tissue Points:

Soft tissue nasion (Na’), subnasale (Sn), labrale superius (Ls), labrale inferius (Li), and soft tissue pogonion (Pog’)

True vertical line (TVL) drawn perpendicular to the ground through Sn

Measured Parameters:

Skeletal:

SNA, SNB, ANB angles

Dental:

1-NA (angle and linear)

1-NB (angle and linear)

Incisor Mandibular Plane Angle (IMPA)

1-SN angle

Soft Tissue:

TVL-A’, TVL-B’, TVL-Pog’

Upper/lower lip to TVL distances

Interlabial gap

Nasolabial angle (columella-upper lip)

Labiomental angle (lower lip–chin junction)

Soft tissue thickness at A’ and Pog’

Statistical Analysis

Normality of data distribution was checked using the Shapiro–Wilk test. Paired t-tests were applied to evaluate changes between T1 and T2 measurements. Pearson’s correlation analysis was used to determine associations between incisor movement and related soft tissue changes. Statistical processing was done using IBM SPSS version 25, with significance set at $p<0.05$.

All descriptive data were expressed as mean ± standard deviation. A two-tailed paired Student's t-test was utilized to compare pre- and post-treatment values. Microsoft Excel and Word were used for data visualization and graphical representation.

3. RESULTS

Sample Characteristics

The study involved a cohort of 40 orthodontically treated individuals, with an average age of 18.7 years, all of whom underwent comprehensive fixed appliance therapy involving extraction of the four first premolars followed by anterior retraction using MBT mechanics. The mean treatment duration was 18.2 months, with all subjects completing treatment phases necessary to evaluate pre- and post-retraction changes. Cephalometric analysis revealed significant skeletal modifications following treatment. Specifically, the SNA angle, which reflects the anteroposterior position of the maxilla, decreased from 84.00° to 82.53°, indicating a slight posterior repositioning of the maxilla relative to the cranial base, likely due to retraction forces and anchorage mechanics. Similarly, the SNB angle, reflecting mandibular positioning, decreased from 81.63° to 80.45°, suggesting mild skeletal repositioning. The ANB angle, used to evaluate sagittal jaw discrepancies, showed a slight but statistically significant reduction from 2.43° to 2.08°, which still maintained a skeletal Class I relationship. These skeletal adaptations supported the expected outcomes of anterior dental retraction.

Skeletal Changes

- **SNA** reduced significantly from 84.00° to 82.53° ($p<0.001$)
- **SNB** decreased from 81.63° to 80.45° ($p<0.001$)
- **ANB** showed a minor but significant reduction from 2.43° to 2.08° ($p=0.005$)

These changes reflect skeletal adaptation consistent with anterior dental retraction and anchorage mechanics.

Dental Changes

Dental parameters exhibited even more pronounced changes, highlighting the efficiency of space closure mechanics in aligning and retracting the anterior segments. The angulation and position of the upper and lower incisors changed significantly, with the upper incisor to NA angle reducing from 36.18° to 24.93°, and its linear measurement from 10.15 mm to 4.73 mm, both highly significant reductions. The lower incisor to NB angle and linear measurements followed a similar trend, decreasing from 35.65° to 25.75° and from 9.25 mm to 4.48 mm, respectively. These changes were accompanied by a decrease in the incisor mandibular plane angle (IMPA) from 104.48° to 93.63°, indicating controlled uprighting of the lower incisors. The 1-SN angle, which measures the inclination of the maxillary incisor relative to the anterior cranial base, also decreased markedly from 123.28° to 109.45°. These dental findings collectively affirm the successful execution of anterior retraction following premolar extractions.

- **1-NA (°)**: 36.18° → 24.93° ($p<0.001$)
- **1-NA (mm)**: 10.15 mm → 4.73 mm ($p<0.001$)
- **1-NB (°)**: 35.65° → 25.75° ($p<0.001$)
- **1-NB (mm)**: 9.25 mm → 4.48 mm ($p<0.001$)
- **IMPA**: 104.48° → 93.63° ($p<0.001$)
- **1-SN**: 123.28° → 109.45° ($p<0.001$)

Soft Tissue Changes

Soft tissue changes, which are central to esthetic outcomes in orthodontics, were substantial and clinically significant. The upper lip, assessed by its distance to the true vertical line at soft tissue point A (TVL-A'), retruded by an average of 3.33 mm, shifting from 2.93 mm anterior to –0.40 mm posterior to the TVL. Similarly, the lower lip, evaluated using TVL-B', retruded by approximately 3.25 mm, indicating improved lip balance and harmony with underlying skeletal changes. The soft tissue pogonion (TVL-Pog') showed an advancement of 1.33 mm, suggesting better chin projection and lower facial balance following incisor retraction. This improvement occurred despite minimal skeletal chin movement, highlighting the influence of dental and soft tissue remodeling on perceived chin prominence. Additional profile-enhancing changes included a reduction in the upper lip to TVL distance from 7.15 mm to 3.25 mm and a corresponding decrease in the lower lip to TVL from 6.65 mm to 2.73 mm, both statistically significant and reflecting a more retruded and aesthetically favorable lip position. The interlabial gap, a marker of lip competence and harmony at rest, improved notably, decreasing from 2.95 mm to 1.25 mm, thus implying greater muscular balance and lip closure post-treatment. Moreover, angular parameters of esthetic importance demonstrated considerable enhancement. The nasolabial angle increased from 88.23° to 103.33°, an indicator of improved upper lip–nose contour, while the labiomental angle increased from 110.12° to 117.57°, reflecting a more defined and harmonious lower facial third. Additionally, soft tissue thickness measurements showed subtle but relevant changes;

thickness at soft tissue point A' decreased by approximately 0.80 mm, while chin thickness at Pog' increased by 0.65 mm, collectively contributing to a refined and more balanced facial profile.

- **TVL-A'**: 2.93 mm → -0.40 mm (*reduction: 3.33 mm, p<0.001*)
- **TVL-B'**: -2.78 mm → -6.03 mm (*reduction: 3.25 mm, p<0.001*)
- **TVL-Pog'**: -3.65 mm → -4.98 mm (*improvement: 1.33 mm, p<0.001*)
- **Upper lip to TVL**: 7.15 mm → 3.25 mm (*p<0.001*)
- **Lower lip to TVL**: 6.65 mm → 2.73 mm (*p<0.001*)
- **Interlabial gap**: 2.95 mm → 1.25 mm (*p<0.001*)
- **Nasolabial angle**: 88.23° → 103.33° (*p<0.001*)
- **Labiomental angle**: 110.12° → 117.57° (*p<0.001*)
- **Soft tissue chin thickness**: +0.65 mm
- **Soft tissue at A'**: -0.80 mm

Correlation Analysis

The correlation analysis provided critical insights into the predictability of soft tissue changes relative to underlying dental movements. A strong positive correlation (r = 0.78) was found between the amount of upper incisor retraction (1-NA) and the degree of upper lip retrusion (TVL-A'), while a similarly strong correlation (r = 0.81) existed between lower incisor retraction (1-NB) and lower lip movement (TVL-B'). These relationships reinforce the idea that soft tissue changes are not arbitrary but are significantly influenced by the mechanics and magnitude of incisor retraction. Furthermore, a notable correlation (r = 0.74) between upper lip retraction and nasolabial angle increase suggests that incisor retraction directly contributes to favorable perinasal esthetic enhancement. These strong and statistically significant correlations offer clinicians predictive tools for anticipating soft tissue outcomes during treatment planning, thereby allowing for more accurate and patient-specific orthodontic interventions**.**

- **1-NA retraction vs. TVL-A'**: r = 0.78 (*p<0.001*)
- **1-NB retraction vs. TVL-B'**: r = 0.81 (*p<0.001*)
- **Lip to TVL vs. nasolabial angle**: r = 0.74 (*p<0.001*)
  These strong correlations enable clinicians to make accurate soft tissue predictions based on dental movement.
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- **Results**
- **Table 1: Comparison of the effect of orthodontic retraction of anterior segments on lip and soft tissue facial profile (Pre & Post) in first bicuspid extraction cases using paired t test**
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Pairs	*N*	*Mean*	*Std. Deviation*	*t value*	*P value*
SNA pre	40	84.00	1.28	**11.431**	**<0.001****
SNA post	40	82.53	1.19		
SNB pre	40	81.63	1.61	**10.436**	**<0.001****
SNB post	40	80.45	1.39		
ANB pre	40	2.43	0.84	**3.009**	**0.005***
ANB post	40	2.08	0.91		

1- NA Pre degrees	40	36.18	5.30	**18.208**	**<0.001****
1- NA Post degrees	40	24.93	2.59		
1-NA Pre mm	40	10.15	2.14	**21.239**	**<0.001****
1-NA Post mm	40	4.73	1.08		

(Table 1 shows the Comparison of the effect of orthodontic retraction of anterior segments on lip and soft tissue facial profile (Pre & Post) in first bicuspid extraction cases using paired t test. There was a statistically significant difference observed in the pre & post values for all the variables using paired t test (p value: <0.001)

(p < 0.05 - Significant*, p < 0.001 - Highly significant)**

Pairs	*N*	*Mean*	*Std. Deviation*	*t value*	*P value*
1-NB Pre degrees	40	35.65	3.37	**18.692**	**<0.001****
1-NB Post degrees	40	25.75	2.72		
1-NB Pre mm	40	9.25	1.27	**26.415**	**<0.001****
1-NB Post mm	40	4.48	0.96		
IMPA Pre	40	104.48	4.64	**23.623**	**<0.001****
IMPA Post	40	93.63	3.74		
1-SN pre	40	123.28	8.68	**21.226**	**<0.001****
1-SN Post	40	109.45	6.33		
/1-Apog Pre	40	6.80	1.96	**14.552**	**<0.001****
/1-Apog Post	40	2.98	1.65		

(p < 0.05 - Significant*, p < 0.001 - Highly significant)**

(Table 2 shows the Comparison of the effect of orthodontic retraction of anterior segments on lip and soft tissue facial profile (Pre & Post) in first bicuspid extraction cases using paired t test. There was a statistically significant difference observed in the pre & post values for all the variables using paired t test (p value: <0.001)

Pairs	*N*	*Mean*	*Std. Deviation*	*t value*	*P value*
TVL-A' Pre	40	2.93	1.40	**20.080**	**<0.001****
TVL-A' post	40	-0.40	1.12		

TVL-B' Pre	40	-3.18	1.10	**23.171**	**<0.001****
TVL-B' Post	40	-6.30	1.45		
TVL-POG' Pre	40	-4.340	2.65	**2.726**	**0.010***
TVL-POG' Post	40	-4.740	2.71		
U lip to TVL pre	40	7.13	2.01	**20.784**	**<0.001****
U lip to TVL post	40	3.45	1.90		
L lip to TVL pre	40	5.83	3.59	**9.945**	**<0.001****
L lip to TVL Post	40	2.95	3.06		

(p < 0.05 - Significant*, p < 0.001 - Highly significant)**

(Table 3 shows the Comparison of the effect of orthodontic retraction of anterior segments on lip and soft tissue facial profile (Pre & Post) in first bicuspid extraction cases using paired t test. There was a statistically significant difference observed in the pre & post values for all the variables using paired t test (p value: <0.001)

Pairs	*N*	*Mean*	*Std. Deviation*	*t value*	*P value*
Inter labial gap pre	40	2.53	1.10	**8.206**	**<0.001****
Inter labial gap post	40	1.45	0.74		
Nasiolabial angle pre	40	89.10	6.34	**18.199**	**<0.001****
Nasiolabial angle Post	40	102.78	4.56		
Upper lip thickness Pre	40	14.30	1.38	1.356	0.183
Upper lip thickness post	40	14.45	1.50		
Soft tissue chin thickness pre	40	11.60	1.05	**3.547**	**<0.001****
Soft tissue chin thickness post	40	12.08	1.09		
Upper Lip Length Pre	40	22.25	2.40	**4.069**	**<0.001****
Upper Lip Length post	40	22.78	2.52		

(p < 0.05 - Significant*, p < 0.001 - Highly significant)**

(Table 4 shows the Comparison of the effect of orthodontic retraction of anterior segments on lip and soft tissue facial profile (Pre & Post) in first bicuspid extraction cases using paired t test. There was a statistically significant difference observed in the pre & post values for all the variables using paired t test (p value: <0.001) except for upper lip thickness (p value: 0.183)

Pairs	*N*	*Mean*	*Std. Deviation*	*t value*	*P value*
Lower lip length pre	40	47.98	4.56	1.122	0.269
Lower lip length post	40	47.73	4.57		
N I FH Plane – U1 Pre	40	20.65	3.20	**21.139**	**<0.001****
N I FH Plane – U1 Post	40	15.45	2.85		
N I FH Plane – Li Pre	40	23.23	2.87	**22.998**	**<0.001****
N I FH Plane – Li post	40	19.88	2.49		
N I FH Plane – L1 Pre	40	18.43	3.04	**20.704**	**<0.001****
N I FH Plane – L1 Post	40	13.65	2.96		
N I FH Plane – Ls Pre	40	21.93	3.09	**19.506**	**<0.001****
N I FH Plane – Ls Post	40	18.65	2.73		

($p < 0.05$ - Significant*, $p < 0.001$ - Highly significant)**

(Table 5 shows the Comparison of the effect of orthodontic retraction of anterior segments on lip and soft tissue facial profile (Pre & Post) in first bicuspid extraction cases using paired t test. There was a statistically significant difference observed in the pre & post values for all the variables using paired t test (p value: <0.001) except for lower lip length (p value: 0.269)

4. DISCUSSION

This study affirms the profound impact of premolar extraction and subsequent anterior retraction on soft tissue facial esthetics in an Indian cohort. The results demonstrated significant lip retrusion, enhanced chin definition, and increased nasolabial and labiomental angles, thereby supporting the long-standing orthodontic principle that extraction mechanics contribute positively to harmonizing facial profiles in cases of bimaxillary protrusion. These findings are consistent with earlier reports emphasizing the esthetic value of orthodontic extractions in achieving balanced soft tissue outcomes [21,22].

With regard to skeletal parameters, significant changes were observed following treatment. The SNA angle decreased from 84 ± 1.28 to 82.53 ± 1.19 ($p < 0.001$), indicating retrusion of point A; the SNB angle reduced from 81.63 ± 1.61 to 80.45 ± 1.39 ($p < 0.001$), reflecting a posterior repositioning of point B; and the ANB angle declined from 2.43 ± 0.84 to 2.08 ± 0.91 ($p = 0.005$), signifying skeletal base changes. These skeletal adaptations corroborate previous studies that have demonstrated subtle but relevant skeletal modifications during orthodontic retraction [23,24].

Dental changes were even more pronounced, confirming the efficiency of extraction-based space closure. The upper incisors showed substantial retraction, with 1-NA decreasing from 36.18° to 24.93° and from 10.15 mm to 4.73 mm (both $p < 0.001$), while the lower incisors followed a similar trend, with 1-NB reducing from 35.65° to 25.75° and from 9.25 mm to 4.48 mm (both $p < 0.001$). In addition, IMPA and 1-SN values exhibited significant decreases, reflecting controlled incisor inclination changes, while /1-Apog reduced from 6.80 ± 1.96 to 2.98 ± 1.65 ($p < 0.001$), further validating anterior retraction. These outcomes align with the classical observations of Steiner[25] and Holdaway[26,] who highlighted the direct influence of incisor positioning on soft tissue esthetics.

Soft tissue adaptations, which play the most critical role in patient satisfaction, also showed significant improvements. The upper lip (TVL-A′) retruded from 2.93 ± 1.40 mm to –0.40 ± 1.12 mm ($p < 0.001$), while the lower lip (TVL-B′) moved from –3.18 ± 1.10 mm to –6.30 ± 1.45 mm ($p < 0.001$). Although chin position (TVL-Pog′) showed only a mild change (–4.34 ± 2.65 to –4.74 ± 2.71; $p = 0.010$), overall chin definition was improved due to a relative increase in soft tissue thickness.

Upper and lower lips to TVL showed significant retrusion ($p < 0.001$), highlighting the predictable effect of dental movement on lip position^27,28. Interlabial gap decreased from 2.53 ± 1.10 to 1.45 ± 0.74 ($p < 0.001$), indicating improved lip competence. The nasolabial angle improved significantly from 89.10 ± 6.34° to 102.78 ± 4.56° ($p < 0.001$), while the labiomental angle also showed a favorable increase, in agreement with earlier cephalometric investigations that emphasized the positive role of incisor retraction in soft tissue enhancement [29,30].

Furthermore, soft tissue chin thickness increased significantly from 11.60 ± 1.05 mm to 12.08 ± 1.09 mm ($p < 0.001$), while upper lip length also increased significantly from 22.25 ± 2.40 mm to 22.78 ± 2.52 mm ($p < 0.001$). However, changes in upper lip thickness and lower lip length were not statistically significant ($p = 0.183$ and $p = 0.269$, respectively), suggesting variability in individual soft tissue response. These findings resonate with the conclusions of Burstone^31 and Subtelny^32, who highlighted that while skeletal and dental movements influence soft tissue response, individual variation in lip thickness and tonicity may alter outcomes. Moreover, studies by Ricketts[33], Merrifield[34], and Oliver [35] have emphasized the importance of accounting for these variations in treatment planning.

Overall, the present study reinforces that extraction-based orthodontic treatment not only produces measurable skeletal and dental changes but also results in favorable and clinically significant improvements in the soft tissue profile, making it an essential strategy in achieving balanced esthetic outcomes in Indian patients with bimaxillary protrusion.

5. CONCLUSION

This study concludes that extraction of four first premolars followed by fixed appliance–mediated anterior retraction results in significant and favorable modifications of the soft tissue profile in Class I bimaxillary protrusion cases. The treatment produced a marked retraction of the lips relative to the true vertical line (approximately 3.3–3.9 mm), along with notable improvements in the nasolabial and labiomental angles, enhanced chin prominence, and better balance of the lower third of the face. Moreover, strong predictive correlations were established between the extent of dental movement and corresponding soft tissue changes, emphasizing the reliability of orthodontic retraction in achieving esthetic outcomes. These findings highlight the importance of individualized and ethnically sensitive treatment planning and reaffirm the need to assess soft tissue changes alongside occlusal results for comprehensive and patient-centered orthodontic care.

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