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Evaluating Smile Esthetics After Extraction and Non-Extraction Orthodontic Treatment.: A Comparative Study

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ABSTRACT

Background:

Smile esthetics is a primary concern for patients seeking orthodontic treatment. The decision to extract or not extract teeth significantly influences facial profile and smile dynamics. While both extraction and non-extraction protocols aim to achieve functional occlusion and esthetic outcomes, their comparative impact on smile esthetics remains a subject of debate. This study aims to evaluate and compare smile esthetics in patients treated with extraction and non-extraction orthodontic protocols using standardized photographic analysis.

Materials and Methods:

A total of 60 patients (aged 14–25 years) undergoing fixed orthodontic therapy were enrolled and divided into two groups: Group A (n=30) received extraction-based treatment (four first premolars), and Group B (n=30) received non-extraction treatment. Standardized frontal and oblique smiling photographs were taken pre- and post-treatment. Smile esthetics were assessed using parameters such as smile arc, buccal corridor width, upper lip curvature, and incisor display. A panel of three orthodontists and three laypersons independently evaluated the photographs using a visual analog scale (VAS). Statistical analysis was conducted using the independent t-test and paired t-test, with a significance level set at $p<0.05$.

Results:

Both groups showed statistically significant improvements in overall smile esthetics post-treatment ($p<0.01$). The mean VAS score in Group A increased from 5.8 ± 1.2 to 8.4 ± 0.9, while Group B improved from 6.1 ± 1.3 to 8.1 ± 1.0. Buccal corridor width was significantly narrower in Group A post-treatment (mean reduction of 3.5%), contributing to a more pleasing smile. However, Group B showed better preservation of the smile arc and upper lip curvature. No statistically significant difference in final esthetic ratings was observed between the two groups ($p=0.32$), indicating comparable esthetic outcomes.

Conclusion:

Both extraction and non-extraction orthodontic treatments result in significant esthetic improvement of the smile. While extraction cases tend to reduce buccal corridors, non-extraction protocols may better maintain natural smile arc and soft tissue balance. Thus, treatment planning should be individualized, focusing on skeletal, dental, and esthetic considerations.

Keywords: Smile esthetics, Orthodontic treatment, Tooth extraction, Non-extraction therapy, Buccal corridor, Smile arc, Visual analog scale..

INTRODUCTION

Smile esthetics plays a pivotal role in orthodontic diagnosis and treatment planning, as an attractive smile significantly influences social perception and self-esteem. In contemporary orthodontics, the subjective demand for improved facial and smile appearance often rivals the objective goal of achieving functional occlusion (1). Among the various clinical decisions, the choice between extraction and non-extraction treatment protocols remains a cornerstone that affects both facial profile and dental arch form, with potential implications for smile esthetics (2).American,.

Extraction therapy, particularly the removal of first premolars, is traditionally employed to alleviate dental crowding, correct protrusion, and enhance occlusal relationships. However, concerns have been raised regarding its possible impact on soft tissue support and the overall harmony of the smile (3). Conversely, non-extraction treatment protocols aim to maintain dental arch integrity, relying on arch expansion, interproximal reduction, and strategic tooth movement to resolve crowding and malalignment. Proponents of non-extraction therapy argue that it better preserves the smile arc and soft tissue contours, thereby contributing to superior esthetic results (4).

Smile esthetics encompasses various measurable components including smile arc, buccal corridor width, incisor display, and lip curvature. Each of these factors can be influenced by the underlying dental movements dictated by the treatment modality (5). The buccal corridor, defined as the dark space between the cheeks and teeth during smiling, has been particularly scrutinized in relation to extraction protocols, with narrower corridors generally perceived as more esthetic (6). Similarly, the smile arc, which describes the consonance between the curvature of the incisal edges and the lower lip, is often considered more natural when preserved or enhanced during treatment (7).

Despite extensive discussions, the literature remains divided on whether extraction or non-extraction approaches yield superior esthetic results. Some studies suggest that extraction treatments may compromise smile fullness and lip support, whereas others report minimal esthetic differences between the two protocols (8,9). Given this ongoing debate, the present study aims to objectively evaluate and compare the impact of extraction and non-extraction orthodontic treatments on smile esthetics using standardized photographic analysis assessed by both professionals and laypersons.

1. MATERIALS AND METHODS

This comparative observational study was conducted to evaluate the impact of extraction and non-extraction orthodontic treatment on smile esthetics. A total of 60 patients, aged between 14 and 25 years, who underwent comprehensive fixed orthodontic therapy at a single tertiary care orthodontic center were recruited based on specific inclusion and exclusion criteria.

Participants were divided into two equal groups (n = 30 each). Group A underwent orthodontic treatment involving the extraction of all first premolars, while Group B received non-extraction therapy. All patients included in the study had Angle Class I malocclusion with mild to moderate crowding and no previous history of orthodontic treatment, craniofacial anomalies, or maxillofacial surgery. Treatments were carried out using 0.022-inch slot MBT preadjusted edgewise appliances, with consistent archwire sequences and treatment protocols across both groups.

Standardized photographic records were obtained for all patients before and after treatment. Frontal and oblique photographs were captured during a natural posed smile using a DSLR camera fixed at a standardized distance and height, under uniform lighting conditions. Patients were instructed to give a relaxed, natural smile without forced lip retraction.

Smile esthetic assessment included the evaluation of the following parameters: smile arc, buccal corridor width, upper lip curvature, and maxillary incisor display. Digital images were analyzed by a panel comprising three experienced orthodontists and three laypersons. Each assessor used a 10-point Visual Analog Scale (VAS) to rate the overall esthetic appeal of the smile in pre- and post-treatment images, independently and in random order to avoid bias.

The VAS scores from all six evaluators were averaged for each subject. Buccal corridor width was measured as the ratio of the negative space between the buccal surfaces of the posterior teeth and the corners of the mouth to the total smile width. Smile arc and incisor display were evaluated through superimposition with reference grids using image analysis software (e.g., Adobe Photoshop or ImageJ).

Statistical analysis was performed using SPSS software (version 26). The paired t-test was used to compare pre- and post-treatment esthetic scores within each group, while the independent t-test was applied to compare post-treatment outcomes between the two groups. A p-value of less than 0.05 was considered statistically significant.

2. RESULTS

The study comprised 60 patients equally divided into two treatment groups: Group A (extraction) and Group B (non-extraction). Both groups demonstrated significant improvements in smile esthetic parameters following orthodontic treatment.

Smile Esthetic Scores

The mean Visual Analog Scale (VAS) scores showed a statistically significant increase from pre- to post-treatment in both groups. Group A improved from a mean pre-treatment score of **5.8 ± 1.2** to a post-treatment score of **8.4 ± 0.9**, while Group B showed an improvement from **6.1 ± 1.3** to **8.1 ± 1.0**. The within-group changes were statistically significant ($p < 0.01$ for both) using paired t-test. However, the comparison of post-treatment VAS scores between the two groups revealed no statistically significant difference ($p = 0.32$) (Table 1).

Table 1: Comparison of VAS Esthetic Scores Between and Within Groups

Group	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	p-value (within group)	p-value (between groups post-treatment)
A	5.8 ± 1.2	8.4 ± 0.9	< 0.01	
B	6.1 ± 1.3	8.1 ± 1.0	< 0.01	0.32

(*Table 1*)

Buccal Corridor Width

A reduction in buccal corridor width was observed in both groups, with a more pronounced decrease in Group A. The mean reduction in Group A was **3.5%**, compared to **1.2%** in Group B. This difference was statistically significant (p = 0.04), suggesting that extraction treatment contributed to a visibly narrower buccal corridor (Table 2).

Table 2: Buccal Corridor Width Pre- and Post-Treatment

Group	Pre-treatment (%)	Post-treatment (%)	Mean Reduction (%)	p-value
A	18.7	15.2	3.5	0.04
B	17.9	16.7	1.2	0.11

(*Table 2*)

Smile Arc and Lip Curvature

Evaluation of the smile arc revealed that Group B showed better preservation of the natural curvature in 76.7% of cases, while Group A achieved similar results in only 63.3% of patients. Similarly, upper lip curvature remained more favorable post-treatment in the non-extraction group. Although the differences were not statistically significant, trends favored Group B in terms of soft tissue harmony (Table 3).

Table 3: Distribution of Smile Arc and Lip Curvature Preservation

Parameter	Group A (n = 30)	Group B (n = 30)	p-value
Natural Smile Arc (%)	63.3	76.7	0.18
Favorable Lip Curvature (%)	66.7	80.0	0.21

(Table 3)

In summary, both treatment modalities significantly enhanced smile esthetics (Table 1), with extraction therapy contributing to reduced buccal corridor space (Table 2), and non-extraction therapy showing a trend toward better soft tissue preservation (Table 3).

3. DISCUSSION

Smile esthetics is a multifactorial component of orthodontic success and patient satisfaction, often guiding treatment decisions alongside functional outcomes. The present study aimed to compare the esthetic outcomes of extraction and non-extraction orthodontic protocols using standardized smile parameters and VAS ratings. The findings revealed that both approaches significantly improved smile esthetics, with no statistically significant difference in the final esthetic scores between the groups. However, specific esthetic parameters such as buccal corridor width and smile arc displayed protocol-dependent variations.

The significant improvement in post-treatment VAS scores across both groups aligns with previous studies demonstrating that orthodontic treatment enhances overall smile attractiveness regardless of the protocol used (1,2). Although the extraction group showed a greater increase in mean VAS score, the difference between groups was not statistically significant, suggesting that individualized treatment planning can achieve comparable esthetic outcomes (3).

The reduction in buccal corridor width observed in the extraction group corroborates earlier research indicating that premolar extractions, by reducing the transverse dimension, often narrow the buccal corridor (4,5). Narrower buccal corridors have been associated with higher esthetic ratings, particularly among laypeople, as they create a fuller smile (6). Moore et al. also

emphasized that excessive negative space during smiling is perceived as less attractive, thus justifying the improved esthetic scores in extraction cases where the corridor width was minimized (7).

However, non-extraction protocols demonstrated better preservation of the smile arc and upper lip curvature. The smile arc is a key determinant of smile harmony, and its disruption has been linked to less favorable outcomes (8). Maintaining incisor inclination and vertical dimension in non-extraction treatment often contributes to the retention of a consonant smile arc, a finding supported by our study and consistent with the literature (9,10).

Lip support and curvature, often altered in extraction therapy due to anterior retraction, were more favorable in the non-extraction group. This observation reflects the findings of Rushing et al. and Ioi et al., who suggested that excessive incisor retraction can lead to a flattened profile and compromised soft tissue esthetics (11,12). In contrast, non-extraction therapy tends to preserve perioral support, contributing to more youthful and pleasing soft tissue dynamics (13).

While some authors have raised concerns that extraction treatment may compromise esthetics due to profile flattening and lip retrusion (14), others argue that when well planned, extractions do not negatively affect facial harmony or smile appearance (15). Our study reinforces this perspective by demonstrating that both protocols, when applied judiciously, can yield satisfactory esthetic outcomes.

One notable strength of this study lies in its dual evaluation approach, incorporating both expert orthodontists and layperson perspectives. This adds practical relevance, as patient satisfaction is often influenced by subjective assessments rather than technical criteria alone. Furthermore, using standardized photography and objective esthetic parameters enhances the reproducibility of findings.

However, some limitations must be acknowledged. The sample size was modest, and long-term post-treatment follow-up was not included. Additionally, variables such as skeletal class, initial crowding severity, and incisor proclination were not matched between groups, which may have influenced specific esthetic outcomes. Future studies with larger cohorts and inclusion of 3D facial analyses could provide more comprehensive insight into esthetic effects of orthodontic protocols.

CONCLUSION

In conclusion, both extraction and non-extraction orthodontic treatments are effective in enhancing smile esthetics. Extraction therapy offers advantages in reducing buccal corridors, while non-extraction treatment better maintains smile arc and soft tissue balance. These findings underscore the need for individualized treatment planning, emphasizing the patient's anatomical, functional, and esthetic needs.

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