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Preliminary Research on Orthodontic Management of Class III Malocclusion: Focus on Non-Extraction Treatment with Illustrative Extraction Cases

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Abstract

Background: Orthodontic management of Class III malocclusion poses clinical challenges, particularly in selecting extraction or non-extraction treatment strategies. Soft tissue profile response is a critical factor in treatment planning, yet available evidence remains limited, especially from preliminary studies with unbalanced treatment distributions.

Objective: This preliminary research aimed to describe orthodontic management of Class III malocclusion with a primary focus on non-extraction treatment, while presenting extraction cases as illustrative clinical examples to demonstrate soft tissue profile changes.

Discussion: A total of 23 patients with Class III malocclusion were included, consisting of 21 non-extraction cases and 2 extraction cases. Soft tissue profile changes were evaluated using pre- and post-treatment lateral cephalometric records and clinical documentation. Findings from non-extraction cases demonstrated variable soft tissue responses, with some patients showing improvement in facial profile harmony, while others exhibited relatively stable soft tissue characteristics. The extraction cases illustrated additional patterns of soft tissue adaptation following extraction-based orthodontic management. Overall, soft tissue responses did not follow a uniform pattern and appeared to be influenced by individual clinical conditions.

Conclusion: This preliminary research highlights the heterogeneous nature of soft tissue responses following orthodontic management of Class III malocclusion. Non-extraction treatment may provide favorable outcomes in selected cases, while extraction treatment illustrates alternative clinical adaptations. These findings emphasize the importance of individualized treatment planning and support the need for further studies with larger and more balanced samples.

Keywords: Class III Malocclusion, Orthodontic Management, Non-Extraction Treatment, Extraction Treatment, and Soft Tissue Profile

Introduction

Class III malocclusion is recognized as one of the most challenging conditions in orthodontics due to the complex interaction between skeletal discrepancies, dental compensation, and soft tissue morphology, which often results in compromised facial esthetics and functional imbalance [1]. The heterogeneity of skeletal patterns and dentoalveolar adaptations in Class III patients makes diagnosis and treatment planning particularly demanding, requiring careful consideration of both functional correction and facial harmony.

Orthodontic management of Class III malocclusion involves a critical decision between extraction and non-extraction treatment approaches. This decision is influenced by multiple factors, including skeletal severity, dental compensation, growth potential, and soft tissue profile characteristics [2]. While non-extraction treatment is often favored in borderline cases to preserve dental arch integrity and avoid invasive procedures, extraction-based treatment may be indicated in selected cases to address crowding, dental compensation, or unfavorable soft tissue conditions. However, the clinical outcomes of these two approaches remain variable, particularly with respect to facial soft tissue response.

Soft tissue profile evaluation has become an essential component of contemporary orthodontic treatment planning, as changes in dentoskeletal relationships do not consistently translate into predictable soft tissue adaptations [3]. Recent three-dimensional and longitudinal studies have demonstrated that orthodontic treatment can induce heterogeneous changes in the lips, chin, and overall facial convexity, even among patients with similar skeletal classifications [4]. These findings underscore the limited reliability of predicting soft tissue outcomes based solely on dental or skeletal correction.

In the context of Class III malocclusion, soft tissue response is particularly complex due to the compensatory role of perioral musculature and the influence of mandibular prognathism on lip posture and chin prominence. Recent evidence comparing extraction and non-extraction treatment in Class III patients suggests that neither approach guarantees uniform soft tissue improvement, and individual variability remains a dominant factor influencing esthetic outcomes [5]. Consequently, treatment decisions should not rely exclusively on extraction criteria but must incorporate comprehensive soft tissue assessment.

Despite advances in orthodontic biomechanics and diagnostic tools, current evidence comparing treatment strategies for Class III malocclusion remains limited and inconclusive. Systematic reviews have highlighted substantial heterogeneity in study designs, sample sizes, and outcome measures, making direct comparisons difficult and limiting the generalizability of findings [6]. In this context, preliminary descriptive studies continue to play an important role by providing early clinical insights into treatment-related soft tissue adaptations without imposing rigid comparative assumptions.

Therefore, the aim of this preliminary research is to describe orthodontic management of Class III malocclusion with a primary focus on non-extraction treatment outcomes, while presenting extraction cases as illustrative clinical examples to highlight the variability of soft tissue profile adaptation following orthodontic intervention.

Material and Methods

This study was designed as a preliminary descriptive clinical study focusing on orthodontic management of Class III malocclusion. A descriptive approach was adopted to describe soft tissue profile changes following orthodontic treatment without performing statistical comparisons between treatment groups, considering the imbalance between extraction and non-extraction cases.

The study sample consisted of 23 patients diagnosed with Class III malocclusion who had completed orthodontic treatment between **2019 untl 2024**. Of these, 21 patients underwent non-extraction treatment, while 2 patients received extraction-based treatment. Data were collected retrospectively from patients' clinical records, including lateral cephalometric radiographs and standardized clinical photographs obtained before and after treatment during the same period.

Soft tissue profile changes were evaluated using soft tissue cephalometric analysis based on pre- and post-treatment records. The parameters assessed included lip position and general facial profile characteristics. Measurements were used to observe the direction and pattern of soft tissue changes following orthodontic treatment.

Data analysis was conducted descriptively, focusing on clinical patterns and variability of soft tissue responses among patients rather than hypothesis-driven statistical testing. This approach was considered appropriate to provide preliminary clinical insights into orthodontic management of Class III malocclusion.

Discussion

Soft Tissue Nasion (N′)

The soft tissue nasion (N′) is widely regarded as a stable landmark following orthodontic treatment, as orthodontic mechanics primarily affect dentoalveolar structures rather than the upper facial third. Because the nasion region is closely associated with the cranial base, orthodontic tooth movement alone is unlikely to induce measurable positional changes in this area. Recent morphometric and cephalometric studies have demonstrated that soft tissue landmarks located in the upper facial third, including N′, show minimal variation after orthodontic treatment, regardless of extraction strategy. These findings indicate that the nasion region is predominantly governed by cranial base configuration and skeletal morphology rather than by dentoalveolar correction [7, 8]. Advanced three-dimensional facial analyses further confirm that orthodontic treatment–related soft tissue adaptations are concentrated mainly in the perioral and lower facial regions. In contrast, upper facial landmarks such as N′ exhibit limited responsiveness and remain relatively unchanged before and after treatment [9]. Moreover, recent systematic evaluations of soft tissue predictability have emphasized that orthodontic-induced changes are least pronounced in cranial-base–related landmarks, reinforcing the concept of structural stability at the nasion [10].

Subnasale (Sn)

Subnasale (Sn) is a transitional soft tissue landmark located at the junction between the nasal base and the upper lip, making it particularly sensitive to orthodontic-induced dentoalveolar changes. In the context of Class III malocclusion treatment, changes in the position of Sn following orthodontic therapy tend to be variable, with many cases demonstrating minimal displacement or relative stability rather than a consistent directional change. The variability in Sn response can be attributed to the influence of maxillary incisor movement and alterations in the nasolabial angle during orthodontic treatment. Recent studies have shown that anterior or posterior movement of the maxillary incisors may indirectly affect the position of Sn through adaptations of the upper lip and nasal base soft tissues. However, the magnitude of these changes is highly dependent on individual soft tissue thickness, muscle tonicity, and facial morphology, resulting in heterogeneous outcomes [11, 12].

Three-dimensional facial analyses further indicate that soft tissue adaptation at the subnasale region follows a nonlinear pattern. Consequently, similar amounts of dentoalveolar correction do not necessarily produce proportional changes in Sn position across different individuals [13]. This nonlinear behavior explains why statistically significant changes at Sn are not consistently observed after orthodontic treatment. Recent systematic reviews have also highlighted that Sn demonstrates moderate predictability in orthodontic treatment outcomes. Although more responsive than cranial

base–related landmarks, its behavior remains less predictable than perioral landmarks such as the lips, emphasizing the importance of individualized soft tissue assessment in orthodontic treatment planning [14].

Pronasale (Prn)

Pronasale (Prn) is a soft tissue landmark representing the most anterior point of the nasal tip and is primarily influenced by nasal morphology rather than dentoalveolar changes. In orthodontic treatment of Class III malocclusion, Prn generally demonstrates a high degree of stability, as conventional orthodontic mechanics have limited direct impact on nasal tip position. Recent literature indicates that changes in Prn following orthodontic treatment are typically minimal and clinically insignificant. This stability can be attributed to the anatomical independence of the nasal cartilaginous framework from orthodontic tooth movement. As a result, orthodontic treatment without orthopedic or surgical intervention is not expected to produce substantial positional changes at the pronasale point [15, 16].

Three-dimensional facial studies further support this observation, showing that orthodontic-induced soft tissue changes are predominantly concentrated in the perioral and lower facial regions, while nasal landmarks such as Prn remain largely unchanged before and after treatment [17]. Minor variations observed at Prn are often associated with natural growth, facial expression during image acquisition, or individual soft tissue thickness rather than treatment-related effects. Systematic reviews published in recent years have emphasized that nasal soft tissue landmarks exhibit low responsiveness to orthodontic intervention. Consequently, Prn is considered a relatively stable reference point in soft tissue profile analysis, reinforcing its limited diagnostic value for evaluating orthodontic treatment effects in Class III malocclusion [18].

Labrale Superius (Ls)

Labrale superius (Ls) represents the most anterior point of the upper lip and is one of the soft tissue landmarks most responsive to orthodontic treatment. In patients with Class III malocclusion, changes at Ls are closely associated with dentoalveolar compensation, particularly maxillary incisor movement and alterations in lip support. Recent studies have demonstrated that orthodontic treatment can induce anterior or posterior displacement of Ls, depending on the direction and magnitude of maxillary incisor movement. Proclination of the maxillary incisors tends to produce forward movement of the upper lip, whereas incisor retraction may result in posterior displacement of Ls. However, the degree of soft tissue response is not uniform and varies according to individual soft tissue thickness and muscle tonicity [19, 20].

Three-dimensional facial analyses further reveal that the relationship between incisor movement and upper lip response is not strictly proportional. In some cases, relatively large dental movements produce only modest changes in Ls position, indicating a dampened soft tissue response. This variability is particularly relevant in Class III camouflage treatment, where dental compensation is often maximized while soft tissue response remains limited [21]. Systematic reviews published within the last five years have consistently identified Ls as a soft tissue landmark with moderate to high predictability compared to nasal or cranial-base–related landmarks. Nevertheless, individual variation remains substantial, underscoring the importance of careful soft tissue evaluation when planning orthodontic treatment strategies for Class III malocclusion [22].

Labrale Inferius (Li)

Labrale inferius (Li) represents the most anterior point of the lower lip and is a soft tissue landmark that is highly responsive to orthodontic treatment, particularly in patients with Class III malocclusion. Changes in Li position are closely related to mandibular incisor movement, lower lip thickness, and the balance between perioral musculature and dentoalveolar compensation. Recent evidence suggests that orthodontic treatment may result in anterior or posterior displacement of Li depending on the direction of mandibular incisor movement. Proclination of the lower incisors tends to advance the lower lip, whereas incisor retraction is often associated with posterior movement of Li. However, the magnitude of this response varies considerably among individuals due to differences in soft tissue thickness and muscular activity [23, 24].

Three-dimensional soft tissue studies have demonstrated that the relationship between mandibular incisor movement and lower lip response is not strictly linear. In many cases, substantial dental movement produces only moderate changes in Li position, reflecting a dampened soft tissue response. This phenomenon is particularly relevant in Class III camouflage treatment, where dental compensation of the mandibular incisors is frequently maximized while soft tissue changes remain limited [25]. Recent systematic reviews have identified Li as a soft tissue landmark with moderate to high responsiveness to orthodontic intervention compared to nasal or cranial-base–related landmarks. Nevertheless, significant interindividual variability persists, highlighting the importance of individualized soft tissue analysis when evaluating treatment outcomes in Class III malocclusion [26].

Soft Tissue Pogonion (Pg′)

Soft tissue pogonion (Pg′) represents the most anterior point of the soft tissue chin and is a key landmark in the evaluation of facial profile, particularly in patients with Class III malocclusion. Changes in the position of Pg′ are closely related to underlying mandibular skeletal morphology rather than dentoalveolar tooth movement. Recent studies indicate that orthodontic treatment without surgical intervention produces minimal changes in the position of Pg′. This limited responsiveness can be attributed to the strong anatomical relationship between the soft tissue chin and the mandibular symphysis, which is largely unaffected by conventional orthodontic mechanics [27, 28]. As a result, Pg′ tends to remain relatively stable following orthodontic camouflage treatment in Class III patients.

Three-dimensional facial analyses further support this finding, demonstrating that soft tissue adaptations in the chin region are generally modest and show weak correlation with dental compensation strategies. Although minor changes in Pg′ may occur due to alterations in lower incisor position or muscular adaptation, these changes are typically small and lack consistent directional patterns [29]. Recent systematic reviews have emphasized that meaningful changes in the soft tissue chin profile are more likely to occur following orthognathic surgery rather than orthodontic treatment alone. Consequently, Pg′ is considered a low-responsiveness landmark in non-surgical orthodontic management of Class III malocclusion, reinforcing its role as a stable reference point in soft tissue profile analysis [30].

Overall Soft Tissue Facial Profile

Overall, non-extraction treatment was associated with a largely stable facial profile, with some cases showing improved facial harmony without dramatic soft tissue displacement. Extraction cases demonstrated more noticeable perioral soft tissue adaptation, although these findings should be interpreted cautiously due to their illustrative nature. These results reinforce the concept that soft tissue facial outcomes in Class III malocclusion are highly individual and cannot be predicted solely based on extraction decisions. Sarver emphasized that facial esthetics result from complex interactions among skeletal, dentoalveolar, soft tissue, and muscular factors [11]. Accordingly, an individualized treatment approach is essential when planning orthodontic management for Class III patients.

Conclusion

Orthodontic management of Class III malocclusion demonstrates heterogeneous soft tissue responses depending on the anatomical location and functional role of each facial landmark. Landmarks associated with the cranial base and nasal region, including the soft tissue nasion (N′) and pronasale (Prn), exhibit high stability and minimal responsiveness to orthodontic treatment, reflecting their strong dependence on skeletal morphology rather than dentoalveolar changes.

In contrast, soft tissue landmarks located in the perioral region show greater variability. Subnasale (Sn) demonstrates moderate and inconsistent responsiveness, influenced by maxillary incisor movement, changes in the nasolabial angle, and individual soft tissue characteristics. Labrale superius (Ls) and labrale inferius (Li) are the most responsive landmarks, closely reflecting dentoalveolar compensation of the maxillary and mandibular incisors, although the magnitude of change remains highly individual and not strictly proportional to tooth movement. Soft tissue pogonion (Pg′) shows limited change following orthodontic camouflage treatment, underscoring the minimal influence of orthodontic mechanics on the chin region in the absence of surgical intervention. Meaningful alterations in Pg′ are more likely associated with orthognathic surgery rather than orthodontic treatment alone.

Overall, these findings highlight the importance of individualized soft tissue evaluation in Class III malocclusion treatment planning. While orthodontic treatment can effectively modify perioral soft tissues, its impact on nasal and chin landmarks is limited. Therefore, realistic esthetic expectations and comprehensive soft tissue analysis should guide clinical decision-making in the management of Class III malocclusion.

Conflict of Interest

The author declares no conflict of interest.

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