



Customized chin cup: enhancing pediatric compliance in Class III orthodontic treatment – a case report

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Abstract

This case report emphasizes the role of a customized chin cup in the management of Class III malocclusion in pediatric patients, emphasizing its contribution to improved compliance and treatment outcomes. Class III malocclusion, often characterized by maxillary retrusion and mandibular prognathism, presents unique challenges in orthodontics, particularly in young patients. Reverse pull facemask therapy is a well-established method to correct maxillary retrusion, but the success of this approach heavily depends on patient compliance. Prefabricated chin cups, commonly used in facemasks, frequently lead to discomfort and irritation, negatively affecting adherence. In this report, we present a simple, cost-effective technique to customize chin cups using polyvinyl siloxane (PVS) for enhanced comfort, stability, and compliance. By improving the fit of the chin cup, this method addresses a critical barrier to successful Class III treatment in pediatric cases.

Keywords

class III malocclusion, customized chin cup, facemask, PVS impression

Introduction

Class III malocclusion is defined by a range of craniofacial anomalies, including mandibular prognathism, maxillary retrusion, or a combination of both.^[1,2] This condition, particularly when left untreated, can lead to functional, esthetic, and psychosocial challenges.^[3] While mandibular prognathism often necessitates surgical correction post-growth, maxillary retrusion can frequently be addressed during the growth period using orthopedic interventions.^[4,5]

Among these interventions, reverse pull facemask therapy, first introduced over a century ago, remains one of the most effective approaches for treating maxillary retrusion. This therapy works by applying forward traction to the maxilla, promoting skeletal changes through circummaxil-

lary suture remodeling, and encouraging favorable occlusal relationships.^[6] Clinical studies have consistently demonstrated the efficacy of this method, especially when combined with rapid maxillary expansion (RME) to mobilize sutures and enhance protraction effects.^[7,8]

Despite its efficacy, the success of facemask therapy depends largely on patient compliance.^[9] Prefabricated chin cups, an integral component of facemasks, often fail to provide a customized fit, resulting in skin irritation, discomfort, and reduced compliance. This challenge underscores the need for solutions that improve the comfort and fit of chin cups, thereby supporting adherence to prescribed wear schedules.

This report introduces a straightforward technique for customizing chin cups using PVS, a material widely avail-

able in orthodontic offices. By addressing comfort-related issues, this technique enhances patient compliance and optimizes the outcomes of Class III malocclusion treatment.

Case presentation

A 10-year-old female patient presented with a skeletal Class III malocclusion characterized by an orthognathic maxilla and prognathic mandible. The patient exhibited a horizontal growth pattern with an anticlockwise rotated mandible. Dental findings are Angle's Class III malocclusion with proclined and forwardly placed upper and lower incisors, upper anterior crowding, and a lower dental midline shift to the right by 3 mm. Additionally, mesiopalatally rotated 14, distopalatally rotated 15, and ectopically erupted 23 (Figs 1, 2).

Treatment objectives

The treatment aimed to address the skeletal discrepancies by improving the maxillomandibular relationship. Specific objectives were correcting overjet and overbite, aligning proclined incisors, resolving upper anterior crowding, managing rotated teeth, addressing the dental midline shift, and eliminating anterior spacing. Secondary objectives included enhancing smile esthetics and managing the high frenal attachment.

Treatment plan

Treatment commenced with bonded RME to mobilize maxillary sutures and reduce lower anterior facial height while

developing the malar area. This was followed by facemask therapy to protract the maxilla and retrude the mandible. Fixed appliance therapy with MBT prescription (0.022" slot) was initiated to achieve leveling, aligning, and en masse retraction of the anterior teeth. Finishing and detailing were planned to establish ideal occlusion and esthetics. Genioplasty was reserved as a possible intervention post-growth completion if needed.

Treatment progress

The treatment began with bonded RME to mobilize the maxillary sutures and enhance the effectiveness of facemask therapy. Facemask therapy was subsequently employed to protract the maxilla and retrude the mandible. The patient complied well with RME and facemask therapy, resulting in significant improvement in the skeletal and dental relationship (Fig. 3).

Challenges faced

The patient initially experienced discomfort and irritation from the poorly adapted chin cup of the facemask. Compliance with the prescribed wear schedule (14–16 hours/day) was suboptimal due to these issues.

Customization technique

1. The chin area was carefully examined to assess its contours and identify potential pressure points. 2. An impression of the chin was taken using PVS impression material to capture the precise anatomy of the area. 3. A chin model was constructed

RIGHT LATERAL VIEW



FRONTAL VIEW



LEFT LATERAL VIEW



MAXILLARY OCCLUSAL VIEW



MANDIBULAR OCCLUSAL VIEW



Figure 1. Intraoral photograph of the patient.



Figure 2. Extraoral photograph of the patient.

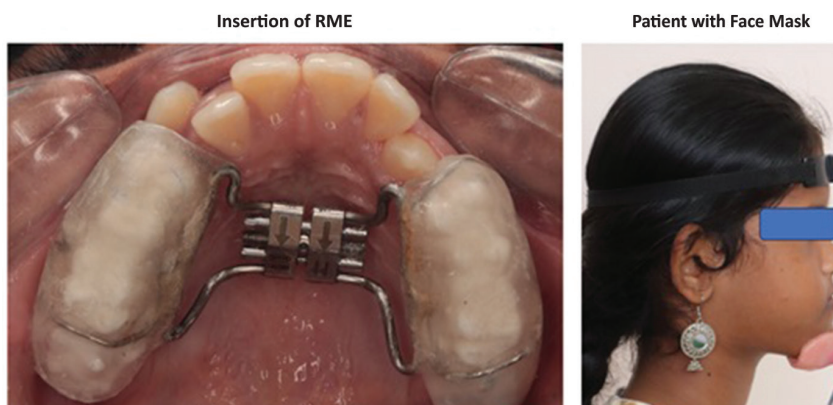


Figure 3. RME and facemask insertion to the patient.

using dental stone from the PVS impression. 4. An acrylic chin support was fabricated over the model to provide a customized fit. 5. A separate impression of the stem attachment point was taken to ensure proper integration with the chin cup. 6. An acrylic stem was fabricated and securely attached to the customized chin support. 7. The completed customized chin cup was then tested for fit and adjusted as necessary to ensure patient comfort and appliance stability (Figs 4-6).

The modified chin cup was provided to the patient after ensuring a snug, comfortable fit. A soft cotton cloth was recommended as an optional protective layer for the skin.

Outcome

The patient reported significant improvement in comfort and wearability. Skin irritation was eliminated, and compliance with the recommended wear schedule improved to over 95%. Follow-up assessments showed no adverse reactions, and the patient expressed satisfaction with the modified appliance. Fixed appliance therapy with MBT prescription (0.022" slot) was initiated on the upper arch to achieve leveling and alignment.

Discussion

Class III malocclusion presents significant treatment challenges, particularly in growing patients, due to its impact on both functional and esthetic aspects. Patients may experience difficulties in mastication, speech, and overall fa-

cial harmony, which can lead to psychosocial stress and reduced quality of life.^[10,11] These challenges underscore the importance of timely and effective intervention to address the complex interplay between skeletal and dental discrepancies.^[12] While facemask therapy is a proven method for correcting maxillary retrusion, its success is closely tied to patient compliance. Prefabricated chin cups, often ill-fitting, can become a major barrier to adherence, leading to suboptimal outcomes.

The customization of chin cups using PVS offers a practical solution to this problem. The described technique not only improves the fit and comfort of the chin cup but also enhances overall appliance stability, supporting better compliance. The use of PVS is particularly advantageous due to its biocompatibility, ease of use, and availability in most orthodontic practices. When used for taking impressions of the chin in the fabrication of customized chin cups, PVS offers several advantages compared to other impression materials such as alginate due to its superior accuracy and detailed reproduction, exceptional dimensional stability, tear resistance, high degree of elastic recovery, controlled setting time, and improved patient comfort. Moreover, unlike alginate, which must be poured immediately to avoid distortion, PVS allows multiple stone casts to be made from a single impression. This is particularly useful in cases where adjustments or refinements to the chin cup design are needed.

This customization technique addresses the limitations of prefabricated facemask chin cups by enhancing their fit and comfort, thus supporting improved dentoskeletal out-



Figure 4. Steps in fabrication of customized chin cup.



Figure 5. Intraoral photograph of the patient after completion of RME and facemask treatment.



Figure 6. Bonding of the upper arch and finishing.

comes. The modified approach facilitates forward maxillary movement while minimizing discomfort, ultimately enabling better compliance. The integration of RME with facemask therapy allows for effective skeletal correction, while the customized chin cup improves treatment adherence, ensuring more predictable and favorable results in managing Class III malocclusion. The forward movement of the maxilla, achieved through a combination of RME and facemask therapy, effectively corrects the skeletal discrepancy, while secondary interventions such as fixed appliance therapy ensure optimal dental alignment and occlusion.

Class III malocclusion is particularly complex due to its variability in presentation. Some cases involve mandibular prognathism, maxillary retrusion, or a combination of both, necessitating individualized treatment approaches.^[13] The early intervention facilitated by this customization technique not only capitalizes on the patient's growth potential but also minimizes the need for more invasive procedures later.^[14] Moreover, integrating this technique into routine practice highlights the value of patient-centered innovations in achieving compliance and enhancing overall treatment success.

By enhancing patient comfort and compliance, this technique may also support treatment in younger patients with mixed dentition or those with special needs. Integrating these customizations into standard orthodontic practice has the potential to improve outcomes across a variety of treatment modalities. The integration of advanced materials and digital technologies may further enhance the precision and efficacy of customized orthodontic solutions.

Conclusion

This case demonstrates the effectiveness of a straightforward method for customizing chin cups in facemasks used for Class III treatment. By addressing the limitations of prefabricated chin cups, this approach enhances patient comfort, compliance, and treatment outcomes. The customization technique represents a valuable addition to the orthodontic armamentarium, particularly in pediatric cases requiring long-term adherence to treatment protocols.

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statements

- The authors declared that no clinical trials were used in the present study.
- The authors declared that no experiments on humans or human tissues were performed for the present study.

- The authors declared that no informed consent was obtained from the humans, donors or donors' representatives participating in the study.
- The authors declared that no experiments on animals were performed for the present study.
- The authors declared that no commercially available immortalised human and animal cell lines were used in the present study.

Use of AI

No use of AI was reported.

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Author contributions

PA: conceptualization, clinical management of the patient; GPM and DS: clinical management of the patient, data collection; HS and RP: literature review, manuscript drafting; SKS: manuscript review and editing, supervision.

Data availability

The data supporting this case report are included within the article. Additional information cannot be shared due to patient confidentiality and ethical considerations.

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