DOI: 10.7860/JCDR/2024/71195.19761

Case Report

Dentistry Section

Management of Mandibular Anterior Demineralisation Associated with Myofunctional Appliance: A Case Report

S ADVAITHA NARAYAN[1], K MADHURAM[2], K SHANMUGAPRIYA[3], ASHOK LEBURU[4], V NAVEEN KUMAR[5]

ABSTRACT

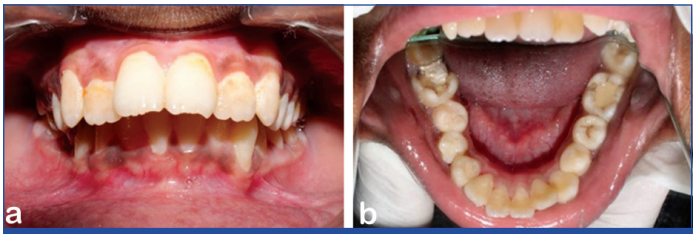
Myofunctional appliances encompass a diverse range of intraoral devices that rely on the intrinsic forces of the orofacial musculature for their functionality. These appliances are typically designed to be removable and exhibit a passive mechanism of action. Caries and demineralisation are well known adverse side effects of myofunctional orthodontic appliances, with the most frequent reports relating to fixed appliance treatment. Hereby, the authors present a case report of a 12-year-old male patient with a slight neuromotor defect who developed significant caries and demineralisation of the permanent mandibular anteriors due to the consumption of large quantities of carbonated drinks and acidic fruits while wearing a twin block appliance for eight months and failing to return for regular orthodontic follow-ups. The patient was provided with strategies for oral health training and diet modification. Fluoride varnish was applied to treat the caries and pain caused by hypersensitivity. Additionally, at-home application of GC Tooth Mousse Plus, which is rich in Casein Phosphopeptide-Amorphous Calcium Phosphate Fluoride (CCP-ACPF), was utilised for remineralisation and dentinal tubule occlusion. The mandibular anteriors were restored with composite resin using an ultra-conservative 3D guided technique, alongside preventive care during the fluoride varnish application. The present case report emphasises the risk of decalcification of teeth during orthodontic treatment and the importance of regular dental check-ups.

Keywords: Central incisors, Injection moulding technique, Remineralisation, Tooth mousse, Twin block appliance

CASE REPORT

A 12-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of severe sensitivity and an inability to chew food with his lower anterior teeth for the past two weeks. The patient had been wearing a myofunctional appliance for the past eight months and noticed sensitivity to hot and cold, along with structural damage, two weeks ago. He reported no history of bruxism.

The patient was conscious, anxious, tall, and lean, with slurred speech and low neuromotor coordination; however, his vital signs were normal. No abnormalities were detected during the extraoral examination, and the intraoral soft tissue examination was unremarkable. Hard tissue examination revealed multiple carious lesions involving Class VI cavities in the mandibular lower anteriors (teeth 31, 32, 33, 41, 42, 43), a root stump in tooth 46, and a fractured composite restoration in tooth 36 [Table/Fig-1a,b-3].



[Table/Fig-1a,b]: Preoperative orthodontic images.

Overall, the caries risk assessment indicated that the patient was at high-risk for caries, based on the Caries Risk Assessment (CRA) form (age>6 years) completed during his first visit to the department. It was determined that the patient frequently consumed sugary foods between meals. There was a history of carious lesions noted in the last six months by the patient's sibling and mother. The patient required special healthcare needs due to neuromotor disabilities that limited his ability to perform adequate oral hygiene independently.

[Table/Fig-2]: Clark's modified Twin Block appliance (mandibular labial segment capping).
[Table/Fig-3]: Preoperative image when reported to the Department of Conservative Dentistry and Endodontic. (Images from left to right).

Additionally, there was a history of prolonged food chewing and food lodgment in the buccal vestibule. The patient had more than three cavitated carious lesions in teeth 36, 16, and 26, along with a composite restoration in tooth 26, within the last 36 months. Visible plaque was also evident, and the patient was undergoing orthodontic treatment.

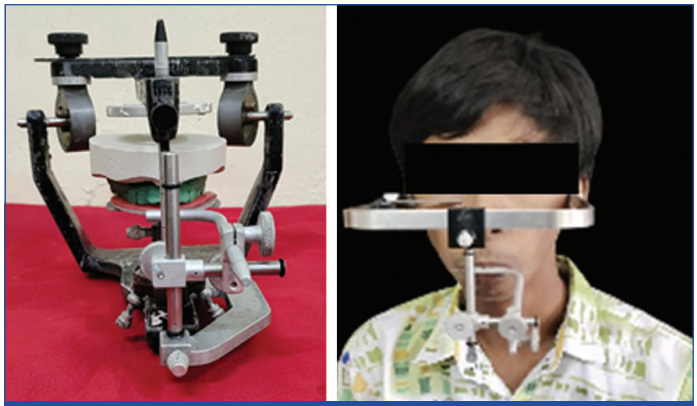
Further investigation was conducted using the Schiff Cold Air Sensitivity Scale (SCASS) (2009) [1], and the preoperative score was 3. Based on the analysis, a diagnosis of mandibular anterior teeth demineralisation associated with the twin block appliance was made.

A preventive regimen was initiated, which included oral prophylaxis, a diet assessment, cessation of the myofunctional appliance, and oral hygiene instructions during the first visit. Additionally, Embrace Varnish (Pulpdent, USA) was applied in-office at the 1st, 2nd, and 4th weeks. At home, a topical crème with bioavailable calcium, phosphate, and fluoride (GC Tooth Mousse Plus™, Leuven, Belgium) was prescribed as a combined therapy along with the varnish application for one month.

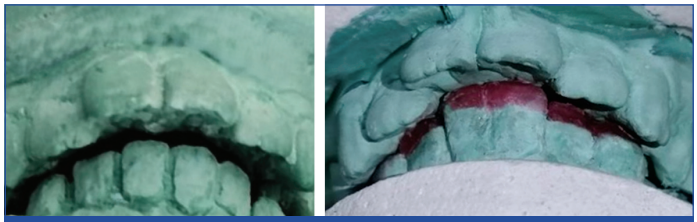
Following an evaluation period of one month, the SCASS scale reading decreased to 1. A Polyethylene Terephthalate Glycol (PTEG) thermoplastic template-guided, three-dimensional, ultra-conservative, and predictable restoration using the injection molding technique was planned for the lower anterior teeth.

To determine the final aesthetic and functional results, a direct composite mock-up [Table/Fig-4] was first created with the patient's approval. The alginate imprint of this mock-up (Zhermack™ Tropicalgin, Italy) was then used as a reference to create the wax-up. After the composite was removed, metal rim lock trays were employed to accurately obtain preoperative upper and lower impressions using Aquasil polyvinylsiloxane (Dentsply Sirona). An anterior deprogrammer (Lucia Jig) and Dawson's bimanual manipulation technique were utilised to obtain a facebow record and a centric relation record. Fujirock EP (GC Corp, Tokyo, Japan) was used to cast the impressions. The casts were mounted on a semi-adjustable Hanau articulator (Amman Girrbach, Pforzheim, Germany) using the centric relation and facebow records [Table/Fig-5] shows the facebow transfer to the Hanau articulator using the indirect transfer method]. An interocclusal clearance of 2 mm was observed by analysing the mounted casts in centric relation [Table/Fig-6]. This information can be used to apply the direct resin composite restoration in a predictable manner to replace the worn lower teeth, and a diagnostic wax-up was performed to achieve canine-guided occlusion [Table/Fig-7].

[Table/Fig-4]: Direct composite mock-up.



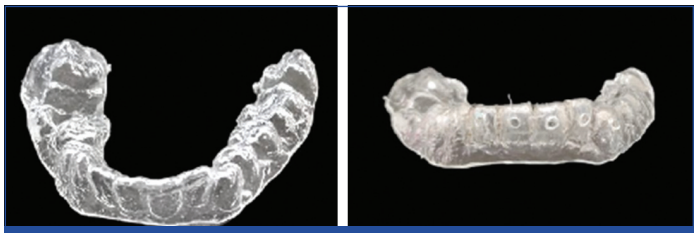
[Table/Fig-5]: Facebow transfer to Hanaus articulator using indirect transfer method.



[Table/Fig-6]: Casts oriented in centric position to demonstrate the existence of a 2 mm interocclusal clearance.
[Table/Fig-7]: Diagnostic waxed-up mandibular cast. (Images from left to right).

A template sheet (Bio-Art Equipamentos Odontologicos LTDA, Europe) [Table/Fig-8] was created by vacuum processing over the mandibular cast, which included all teeth except the distal-most ones. A 0.5 mm PTEG thermoplastic template was made using a stone duplicate model of the diagnostic wax-up. After modification, the template was finalised with a flat marginal contour and extended 2 mm beyond the marginal gingiva for stability and stiffness.

A round bur (BR-40) (Brasseler, GA, USA) was used to create loading holes on the buccal surfaces of the lower anterior teeth after the template had been sectioned interdentally using a preheated blade #15 [Table/Fig-9]. The loading holes were positioned approximately halfway between the ideal incisal edge and the current occlusal surface, with the slits extending 3-4 mm beyond the required interproximal contact region [2].



[Table/Fig-8]: The 0.5 mm Polyethylene Terephthalate Glycol (PTEG) thermoplastic template formed by vacuum processing machine.
[Table/Fig-9]: The template was sectioned interdentally using a heated blade, reaching 2 mm beyond the interproximal contact region. A round bur (BR-40) was then used to make loading holes on the buccal surfaces. (Images from left to right).

The intraoral assessment of the template fit ensured that the intended mylar strip matrices (Palodent system, Dentsply Caulk, Milford, US) were positioned interproximally [Table/Fig-10] in a passive manner. Rolls of cotton wool and ample suction were used to establish isolation. Using a micro brush, GC G-Premio Bond was applied to the dentin and enamel of each tooth. It was then dried with a three-way syringe and cured for 20 seconds on all surfaces. Petroleum jelly was applied to the template before the resin was injected into it. After the patient placed the template in their mouth, the mylar strip matrices were positioned between the templates. G-aenial composite was injected through the labial hole of the template, and to prevent unwanted overflow, digital pressure was applied to the lingual side of the template. To avoid air entrapment, the resin was also introduced carefully using a back-flow method. Light curing was performed with a Demi™ Ultra LED (Kerr Corp, CA, USA) through the template for 60 seconds on each surface. Excess resin in the sprue region was wiped away using a flat plastic tool before light curing, as this could complicate the removal of the template.

The template was then removed, and the matrices were eliminated. The initial finishing step involved removing the surplus using a fine diamond bur (Brasseler, GA, USA). Mini Flex disks were used to complete the polishing. An articulating paper was employed to assess the occlusion [Table/Fig-11]. The final gloss was achieved using Aster Prophy paste (Ivoclar Vivadent AG, Schaan, Liechtenstein) and an Astrobrush [Table/Fig-12]. Intermittent follow-ups were conducted at 3, 6, and 12 months, and images were taken after oral prophylaxis [Table/Fig-13].

DISCUSSION

Caries and demineralisation are recognised and detrimental outcomes associated with the use of Twin Block appliances. To address the high caries index and sensitivity to hot and cold, both in-office and at-home procedures were implemented.

Fitzpatrick W et al., elaborated on the subsequent restoration using direct resin composite and the concomitant preventive application of fluoride varnish on extensively decalcified permanent mandibular anteriors following long-term functional appliance therapy [3]. In a case report by Mehta SB et al., an injection molding technique was used to restore the worn mandibular anterior dentition with direct resin composite [4].

[Table/Fig-10]: PTEG template and separating mylar matrices.
[Table/Fig-11]: Postoperative image indicating the occlusal contacts with articulating paper. (Images from left to right)

[Table/Fig-12]: Final postoperative view.
[Table/Fig-13]: Follow-up after one year. (Images from left to right)

The primary aim of treatment was to prevent further teeth demineralisation, relieve the patient of severe sensitivity, and discontinue the use of the Twin Block appliance. A proper dietary assessment was conducted, and oral hygiene advice was provided. The pH range of carbonated beverages (e.g., cola, Sprite) and acidic fruit juices (e.g., kiwi, orange) is between 2.5 and 3.5 [4]. Frequent consumption of these drinks between meals can lead to the demineralisation of dental hard tissues, as the oral cavity's pH can drop below 5.5, allowing calcium and phosphate ions to leach out of the enamel [5].

Remineralisation was initiated through a combined therapy involving the application of fluoride varnish in the office during the 1st, 2nd, and 4th weeks consecutively, along with a prescribed at-home application of topical cream containing bioavailable calcium, phosphate, and fluoride.

Embrace Varnish is a resin-based varnish containing xylitol, 5% sodium fluoride, calcium, and phosphorus, with ethanol added as a solvent. Saliva dissolves the xylitol and reacts with phosphate ions and calcium, along with fluoride ions from saliva, to form fluorapatite. Significant fluoride release was evident during the initial four hours, achieving an effective tubule-occluding and remineralising effect [6].

Recaldent, a milk-derived protein with integrated fluoride, is a component of GC Tooth Mousse Plus (CPP-ACPF). The fluoride content is 0.2% w/w (900 ppm), which is comparable to adult-grade toothpaste. GC Tooth Mousse Plus offers additional protection for teeth, relief from sensitivity, buffering of dental plaque acidity from oral bacteria, and defense against acidic foods and beverages [7].

Since, the patient had low neuromotor coordination, excess mucous salivary flow, and was uncooperative and anxious, an injection molding technique was planned for precise results. This 3D ultra-conservative approach requires no tooth adjustments, reduces chair time, minimises material wastage, and accurately transfers from the wax-up [8]. Although many reports and studies have recommended alternative methods for restoring teeth and packing Teflon on adjacent teeth to develop appropriate contact points and adequately finish and polish the composite in interdental areas [9-11], the technique used to establish contact and incisal build-up was adapted from the case report of Mehta SB et al., [4]. While this technique was labour-intensive, it ultimately saved time intraorally and was the most suitable approach for present case.

As an 8th-generation universal bond that produces a nano-interaction zone for better bond strength to both enamel and dentin, G Premio Bond was utilised in this particular case as a self-etch adhesive. To reduce microleakage, microbial invasion, and sensitivity, a 5% filler content helps to close tubules, creating fewer spaces between the thin adhesive layer and the dentin [12].

G-ænial Universal Injectable Resin is a light-cured, radiopaque universal high-strength composite with excellent viscosity and perfect direct syringe application. It has enhanced thixotropic properties, allowing for the creation of durable restorations with minimal manipulation. This resin consists of a high filler rate of 69 wt.% with ultra-fine barium particles (150 nm) that are secured by a full-coverage silane coating to the resin matrix [13].

Several techniques have been proposed to create highly predictable aesthetic composite restorations that mimic the anatomy of anterior teeth. These techniques include using silicone indexes for the palatal surface, transparent silicone indexes for the entire surface, or the conventional incremental technique [14,15]. Flowable resin composites have advantages over packable materials, including better adaptability to pulpal limits and the ability to directly fill cavities with narrow gauge dispensers. However, they contain fewer filler particles and more organic content, resulting in reduced mechanical characteristics, wear susceptibility, polishability, and colour stability [16].

CONCLUSION(S)

The primary aim of diminishing patient sensitivity was successfully achieved. The oral hygiene and diet regimen were rectified. Biomechanical and occlusal principles were employed to fabricate a diagnostic wax-up, and a template was created to place the resin composite restoration directly to restore the lower anterior dentition using the injection molding technique. This technique has the potential to offer optimal form, function, and aesthetic outcomes efficiently for this patient with special healthcare needs. During regular follow-ups, the longevity and colour stability of the restoration were assessed. Periodic oral prophylaxis, as part of the restoration maintenance phase, was essential to prevent stain uptake and maintain the colour stability of the flowable resin. This approach serves as a clinical alternative to the traditional layered technique for anterior restorations, although it is not intended to replace it. For improved and more accurate results, a digital workflow technique could be planned using digital smile design software.

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PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Student, Department of Conservative Dentistry and Endodontics, Karpaga Vinayaga Institute of Dental Science, Chennai, Tamil Nadu, India.
2. Head, Department of Conservative Dentistry and Endodontics, Karpaga Vinayaga Institute of Dental Science, Chennai, Tamil Nadu, India.
3. Postgraduate Student, Department of Conservative Dentistry and Endodontics, Karpaga Vinayaga Institute of Dental Science, Chennai, Tamil Nadu, India.
4. Professor, Department of Conservative Dentistry and Endodontics, Karpaga Vinayaga Institute of Dental Science, Chennai, Tamil Nadu, India.
5. Professor, Department of Conservative Dentistry and Endodontics, Karpaga Vinayaga Institute of Dental Science, Chennai, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. S Advaitha Narayan,
Postgraduate Student, Department of Conservative Dentistry and Endodontics,
Karpaga Vinayaga Institute of Dental Science, Chennai-603308, Tamil Nadu, India.
E-mail: sadvaitha@yahoo.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 11, 2024
- Manual Googling: May 23, 2024
- iThenticate Software: Jul 03, 2024 (5%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Apr 10, 2024**
Date of Peer Review: **May 21, 2024**
Date of Acceptance: **Jul 04, 2024**
Date of Publishing: **Aug 01, 2024**