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Original Research Paper

Prosthodontics

CONSERVATIVE ESTHETIC REHABILITATION OF SINGLE ANTERIOR EDENTULOUS SPACES USING RESIN-BONDED FIXED DENTAL PROSTHESES

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ABSTRACT The replacement of a missing anterior tooth requires careful consideration of esthetics, function, and preservation of existing tooth structure. While implant-supported restorations are frequently considered the treatment of choice, their use may be limited by insufficient bone volume, the need for additional surgical procedures, financial constraints, or patient preference. In such situations, resin-bonded fixed dental prostheses offer a conservative and effective alternative. This article describes two clinical cases involving the rehabilitation of single anterior edentulous spaces using lithium disilicate resin-bonded prostheses fabricated through a fully digital workflow. In the first case, a conventional Maryland bridge was used to restore a traumatically lost maxillary anterior tooth in a patient presenting with an anterior open bite and favorable occlusal conditions. The second case involved the use of a Reverse Anterior Maryland Bonded (RAMBo) bridge in a patient with an enlarged mesiodistal edentulous space and inadequate alveolar bone width for implant placement. Both restorations were designed using CAD-CAM technology and adhesively bonded following minimally invasive tooth preparation. The treatment outcomes demonstrated satisfactory esthetics, phonetics, and function, with preservation of healthy tooth structure and high patient acceptance. These cases illustrate the clinical applicability of conventional and reverse Maryland bridge designs as conservative treatment options for anterior tooth replacement, particularly when implant therapy is not feasible or desired.

KEYWORDS : Resin-bonded Fixed Dental Prosthesis, Maryland Bridge, Reverse Maryland Bridge, RAMBo Bridge, Lithium Disilicate, CAD-CAM Dentistry, Anterior Tooth Replacement, Minimally Invasive Prosthodontics

INTRODUCTION

Replacement of a single missing anterior tooth remains one of the most challenging procedures in restorative and prosthetic dentistry because of the high aesthetic, functional, and psychological demands associated with the anterior region. Loss of an anterior tooth may occur due to trauma, caries, periodontal disease, or congenital absence and can significantly affect smile aesthetics, phonetics, masticatory efficiency, and patient self-confidence[1]. Consequently, restoration of anterior edentulous spaces requires treatment approaches that provide optimal aesthetics and function while preserving the health of adjacent teeth.

Several treatment modalities have been proposed for the replacement of a single missing anterior tooth, including removable partial dentures, conventional fixed dental prostheses, resin-bonded fixed dental prostheses (RBFDPs), and implant-supported restorations. Although implant-supported prostheses are widely regarded as a predictable and conservative treatment option, their application may be limited by inadequate bone volume, proximity to anatomical structures, financial considerations, medical contraindications, or patient reluctance to undergo surgical procedures. In such situations, minimally invasive tooth-supported prosthetic alternatives become valuable treatment options.

The concept of resin-bonded fixed dental prostheses was first introduced by Rochette in the 1970s and subsequently refined by Livaditis and Thompson with the development of the Maryland bridge[3,4,5,6]. Since then, significant advancements in adhesive dentistry, ceramic materials, and digital technologies have contributed to improved clinical outcomes and long- term success of these restorations. Conventional Maryland bridges utilize lingual or palatal retainers bonded to enamel surfaces of adjacent teeth, thereby minimizing tooth preparation and preserving healthy dental tissues.

Various modifications of Maryland bridge designs have been introduced to enhance aesthetics, retention, and biomechanical performance[9,10,11,12,13]. These include cantilever Maryland bridges, fiber-reinforced composite bridges, all-ceramic Maryland bridges, Carolina bridges, Procera Maryland bridges, and more recently, Reverse Anterior Maryland Bonded (RAMBo) bridge designs. The reverse Maryland concept employs facial veneer retainers instead of conventional palatal retainers and may be particularly advantageous in cases with excessive mesiodistal pontic spaces, midline diastema, or compromised tooth proportions where conventional designs may not provide an optimal aesthetic outcome.

The introduction of high-strength adhesive ceramics such as lithium disilicate has further expanded the indications for resin-bonded prostheses. Lithium disilicate combines excellent optical properties, favorable flexural strength, and reliable adhesive bonding, making it an ideal material for minimally invasive anterior restorations[14,15]. Additionally, digital workflows involving intraoral scanning, computer-aided design, and computer-aided manufacturing (CAD-CAM) have improved the precision, efficiency, and predictability of prosthesis fabrication.

The present article describes two clinical cases demonstrating conservative rehabilitation of single anterior edentulous spaces using lithium disilicate resin-bonded fixed dental prostheses fabricated through a digital workflow. The first case was managed with a conventional Maryland bridge, while the second utilized a Reverse Anterior Maryland Bonded (RAMBo) bridge in a situation where implant therapy was not feasible because of compromised alveolar bone width and unfavorable space relationships. These cases highlight the versatility of resin-bonded prostheses in achieving functional and esthetic rehabilitation while preserving maximum tooth structure.

CASE PRESENTATION

Case 1- Conventional Maryland Bridge

A 39-year-old female patient reported to the Department of Prosthodontics with a chief complaint of a missing maxillary lateral incisor following trauma three years previously. The patient had been wearing a removable temporary prosthesis

since the loss of the tooth but expressed dissatisfaction with its aesthetics and comfort. She desired a fixed replacement that would restore both function and appearance. Clinical examination revealed healthy adjacent teeth with adequate enamel surface available for bonding, satisfactory periodontal health, and ananterior open bite providing favorable occlusal clearance. Radiographic evaluation showed adequate support of the adjacent teeth without any pathological findings. The existing edentulous space was deemed suitable for rehabilitation using a resin-bonded fixed dental prosthesis.

Figure 1. Preoperative Frontal Smile View Showing Missing Maxillary Anterior Tooth.

Figure 2. Preoperative Intraoral Frontal View

Various treatment options, including an implant- supported restoration, conventional fixed partial denture, and resin-bonded fixed dental prosthesis,were discussed with the patient. Although implant therapy was considered, the patient preferred a more conservative and economical treatment option. Considering the favorable occlusal relationship, adequate enamel availability, and the desire to preserve healthy tooth structure, a conventional Maryland bridge was selected as the definitive treatment.

Preliminary maxillary and mandibular impressions were made using irreversible hydrocolloid impression material, and diagnostic casts were obtained in dental stone. The casts were mounted and evaluated to assess pontic space, path of insertion, interocclusal clearance, and occlusal relationships. Shade selection was performed under natural daylight conditions before tooth preparation to ensure accurate colour matching with the adjacent dentition.

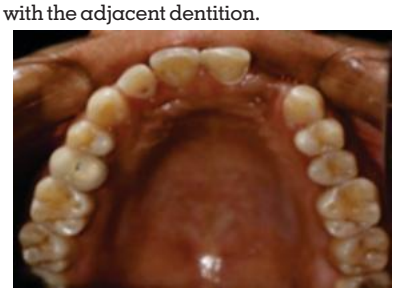

Figure 3. Minimal Palatal Preparation of Abutment Teeth

Minimal palatal preparation was carried out on the adjacent abutment teeth while maintaining the preparation entirely within enamel. The preparation design included slight palatal reduction with supragingival finish lines, conservative proximal extension for improved retention, and rounded internal line angles. Every effort was made to preserve maximum tooth structure in accordance with the principles of minimally invasive dentistry.

Figure 4. Digital Intraoral Scan Used for CAD-CAM Design

Following tooth preparation, digital impressions of both arches and the interocclusal relationship were obtained using an intraoral scanner. The digital workflow enabled precise recording of preparation margins, pontic space morphology, and occlusal relationships. The digital data were transferred to CAD software, where the prosthesis was designed with careful consideration of pontic contour, emergence profile, connector dimensions, retainer thickness, and occlusal clearance. A conservativeretainer design was maintained to maximize enamel bonding and esthetic outcomes.

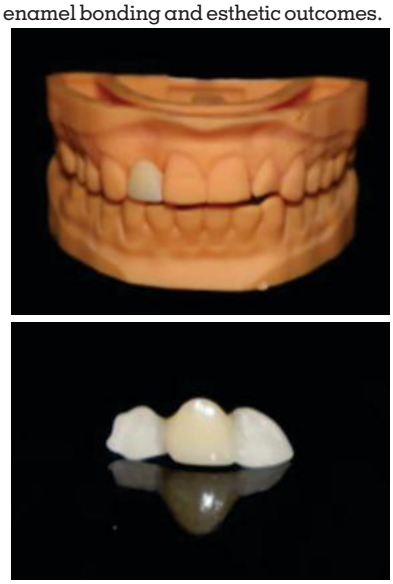

Figure 5. Fabricated Lithium Disilicate Maryland Bridge

The prosthesis was fabricated from lithium disilicate ceramic using CAD-CAM technology. Lithium disilicate was selected because of its excellent esthetic characteristics, translucency, adhesive bonding properties, and adequate mechanical strength for anterior applications. The completed restoration was evaluated intraorally for marginal adaptation, passive fit, shade match, pontic contour, phonetics, and occlusion. Minor adjustments were performed where necessary before final cementation.

For cementation, the intaglio surface of the restoration was conditioned with 5% hydrofluoric acid, followed by silane application and adhesive treatment. The enamel surfaces of the abutment teeth were cleaned, etched with 37% phosphoric acid, and treated with a compatible bonding agent. The prosthesis was then seated using dual-cure resin cement under adequate isolation. Excess cement was removed, and complete polymerization was achieved by light curing from multiple directions. Final finishing and occlusal adjustments were carried out to eliminate premature contacts and ensure functional harmony, particularly considering the patient's anterior open bite.

Figure 6. Final Postoperative Smile View.

Postoperative evaluation demonstrated satisfactory esthetic integration with the adjacent dentition, improved smile appearance, acceptable phonetics, and functional comfort. The patient expressed satisfaction with the final outcome. Oral hygiene instructions and maintenance protocols were explained, and periodic follow-up visits were scheduled to monitor prosthesis retention, gingival health, occlusal stability, and overall patient satisfaction.

CASE 2- Reverse Anterior Maryland Bonded (RAMBo) Bridge
A 35-year-old female patient presented to the Department of Prosthodontics with a chief complaint of a missing maxillary anterior tooth and dissatisfaction with her smile aesthetics. Clinical examination revealed an increased mesiodistal edentulous space associated with disproportionate anterior tooth dimensions and spacing in the aesthetic zone. The adjacent teeth were periodontally healthy and suitable for adhesive rehabilitation.

Figure 7. Preoperative Frontal Smile View Showing Excessive Mesiodistal Pontic Space.

Figure 8. Preoperative Intraoral Frontal View

Figure 9. Maxillary Occlusal View

Smile analysis demonstrated that replacement of the missing tooth with a conventional resin-bonded fixed dental prosthesis would result in an unaesthetic pontic width because of the excessive mesiodistal space.Radiographic and cone-beam computed tomography (CBCT) evaluation revealed compromised alveolar bone width at the edentulous site, making implant placement unfavorable without additional bone augmentation procedures. Although implant-supported rehabilitation was initially discussed, the patient was unwilling to undergo surgical augmentation and preferred a conservative treatment alternative. Considering the excessive pontic space, compromised bone volume, and the patient's desire for minimally invasive treatment, rehabilitation using a Reverse Anterior Maryland Bonded (RAMBo) bridge was planned.Preliminary maxillary and mandibular impressions were made using irreversible hydrocolloid impression material, and diagnostic casts were obtained in dental stone. A diagnostic wax-up and smile analysis were performed to evaluate tooth proportions, pontic dimensions, smile symmetry, midline position, and available restorative space. The diagnostic evaluation confirmed that correction of tooth proportions and redistribution of the excessive pontic space would be required to achieve a harmonious esthetic result. A diagnostic wax-up was performed to establish the proposed tooth proportions, pontic dimensions, smile symmetry, and midline position. Based on the wax- up, a silicone putty index was fabricated and used for intraoral mock-up transfer with bis-acryl provisional material. The mock-up allowed evaluation of the proposed esthetic outcome, phonetics, lip support, and smile harmony directly in the patient's mouth.

Particular attention was given to the redistribution of the excessive mesiodistal pontic space and correction of the apparent tooth proportions. Following patient approval of the mock-up and proposed smile design, the definitive RAMBo bridge treatment plan was finalized.

Figure 10. Intraoral Mock-up Transfer Using Silicone Index.

Following shade selection under natural daylight conditions, conservative facial preparation was carried out on the adjacent abutment teeth in the form of porcelain laminate veneer preparations.

Preparation was confined to enamel and performed using fine-grit diamond rotary instruments under water cooling. The preparation design included minimal facial reduction, supragingival finish lines, rounded internal line angles, and conservative proximal extension where required. Particular emphasis was placed on preserving enamel to maximize adhesive bonding and long-term retention.

Figure 11. Facial Veneer Preparation of Abutment Teeth.

Digital impressions of both arches and the interocclusal relationship were obtained using an intraoral scanner. The digital records were transferred to CAD software for virtual design of the prosthesis. Special attention was given to correction of tooth proportions, pontic morphology, emergence profile, veneer-retainer contours, smile symmetry, and overall esthetic integration. Unlike conventional Maryland bridge designs, the facial veneer retainers allowed modification of the apparent tooth dimensions and effective management of the excessive mesiodistal pontic space.

Figure 11: Digital Intraoral Scan.

A provisional restoration was fabricated to evaluate esthetics, phonetics, and patient acceptance before definitive treatment.

Figure 12: Temporization of the Reverse Maryland Bridge.

Following successful clinical evaluation of the provisional phase, the definitive prosthesis was fabricated from lithium disilicate ceramic using CAD-CAM technology. The restoration was selected because of its superior translucency, esthetic characteristics, favorable mechanical properties, and excellent adhesive bonding potential.

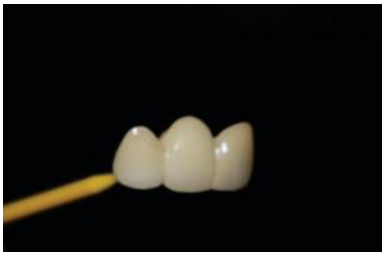

Figure 13: Fabricated Lithium Disilicate RAMBo Prosthesis.

During the try-in appointment, the prosthesis was evaluated for marginal adaptation, shade compatibility, smile harmony, pontic contour, veneer adaptation, phonetics, and occlusion. Necessary adjustments were carried out before definitive cementation. The intaglio surface of the restoration was conditioned using hydrofluoric acid followed by application of a silane coupling agent. The prepared enamel surfaces were cleaned, etched with phosphoric acid, and treated with an adhesivebonding agent. The prosthesis was subsequently luted using dual-cure resin cement under adequate isolation. Excess cement was removed, and final polymerization was completed using a light-curing unit.

Following cementation, occlusion was assessed in centric and eccentric movements and adjusted where necessary to eliminate premature contacts and ensure functional harmony. Postoperative evaluation demonstrated significant improvement in smile aesthetics, correction of tooth proportions, satisfactory phonetics, and excellent integration with the adjacent dentition. The patient expressed a high level of satisfaction with the final outcome. Oral hygiene instructions and maintenance protocols were provided, and periodic recall visits were scheduled to evaluate prosthesis retention, gingival response, marginal integrity, occlusal stability, and overall patient satisfaction.

Figure 14. Postoperative Intraoral View After Cementation

Figure 15. Final Postoperative Smile View

DISCUSSION

Replacement of a single missing anterior tooth continues to be a restorative challenge because of the high aesthetic and functional demands associated with the anterior region. Treatment planning should aim to restore aesthetics, phonetics, and function while preserving the maximum amount of healthy tooth structure. Although implant-supported restorations are considered a predictable treatment modality, limitations such as inadequate bone

volume, the need for augmentation procedures, financial considerations, and patient preference may necessitate alternative conservative treatment approaches.

Resin-bonded fixed dental prostheses (RBFDPs) have gained considerable popularity because they require minimal tooth preparation and preserve enamel, thereby improving the predictability of adhesive bonding. Since the introduction of the Maryland bridge by Livaditis and Thompson, several modifications have been proposed to improve retention, aesthetics, and biomechanical performance. Recent advancements in adhesive dentistry, ceramic materials, and digital technologies have further enhanced the clinical success of these restorations.

In the first case, a conventional Maryland bridge was selected because of the favorable occlusal conditions, adequate enamel surface available for bonding, and the presence of an anterior open bite. The open bite minimized functional loading on the prosthesis and created an ideal environment for long-term success. The use of palatal retainers preserved facial enamel and allowed a conservative restoration with satisfactory esthetic and functional outcomes.Previous studies have reported favorable survival rates for Maryland bridges when proper case selection, enamel bonding, and occlusal management are maintained.

The second case presented a different clinical challenge. The presence of an excessive mesiodistal edentulous space and compromised alveolar bone width made implant therapy less favorable without additional augmentation procedures. Furthermore, a conventional Maryland bridge would have resulted in an unaesthetic pontic width and compromised tooth proportions. To overcome these limitations, a Reverse Anterior Maryland Bonded (RAMBo) bridge was planned. The use of facial veneer retainers allowed redistribution of the excessive pontic space and correction of tooth proportions, resulting in improved smile harmony and esthetics. The diagnostic wax-up and intraoral mock-up transfer played a crucial role in visualizing the final outcome and obtaining patient approval before definitive treatment.

Both cases benefited from a fully digital workflow involving intraoral scanning, CAD design, and CAD- CAM fabrication. Digital dentistry offers several advantages, including improved accuracy, efficient communication with the laboratory, enhanced prosthesis design, and reduced errors associated with conventional impression techniques. In addition, the digital workflow facilitates predictable management of esthetic parameters such as emergence profile, pontic contour, and tooth proportions.

Lithium disilicate ceramic was selected for both restorations because of its excellent optical properties, favorable flexural strength, and reliable adhesive bonding characteristics. Numerous clinical studies have demonstrated high survival rates and predictable long-term performance of lithium disilicate restorations in the anterior region. The ability to fabricate conservative restorations with superior translucency makes lithium disilicate particularly suitable for resin-bonded prostheses in the esthetic zone.

The successful outcomes observed in both cases emphasize the importance of appropriate case selection, meticulous adhesive protocols, careful occlusal assessment, and comprehensive esthetic planning. While the conventional Maryland bridge remains a predictable option in cases with favorable occlusion and adequate pontic space, the RAMBo bridge may provide a valuable alternative in situations involving excessive pontic space, compromised tooth proportions, or when implant therapy is not feasible.

CONCLUSION

Resin-bonded fixed dental prostheses provide conservative and effective treatment options for the replacement of single missing anterior teeth while preserving maximum tooth structure. The conventional Maryland bridge remains a predictable solution in cases with favorable occlusal conditions and adequate space relationships. In contrast, the Reverse Anterior Maryland Bonded (RAMBo) bridge offers an innovative and esthetically advantageous alternative for patients presenting with excessive mesiodistal pontic spaces, compromised tooth proportions, or situations in which implant therapy is not feasible.

The incorporation of digital workflow, CAD-CAM technology, and lithium disilicate ceramics contributed significantly to the precise fabrication and successful clinical outcomes achieved in both cases. Careful diagnosis, meticulous adhesive bonding procedures, and appropriate case selection remain essential for the long-term success of resin-bonded prostheses. Within the limitations of these case reports, both treatment approaches demonstrated satisfactory esthetic and functional rehabilitation with high patient satisfaction.

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