

Tailored Cast Partial Denture Rehabilitation Across Different Kennedy Classifications: A Case Series

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ABSTRACT

Background: The prosthodontic rehabilitation of partially edentulous arches requires careful consideration of biomechanical, functional, esthetic, periodontal, and patient-related factors. Although implant-supported treatment has expanded the available therapeutic options, cast removable partial dentures (RPDs) remain a conservative, predictable, and cost-effective treatment modality, particularly when implant therapy is declined, contraindicated, or impractical. Selection of an appropriate prosthetic design should therefore be individualized according to the clinical presentation rather than based solely on the pattern of tooth loss.

Case Presentation: This case series describes the rehabilitation of three female patients presenting with different patterns of partial edentulism. A 50-year-old patient with a mandibular Kennedy Class II Modification 2 arch and high esthetic expectations was rehabilitated with a precision attachment-retained cast removable partial denture. A 34-year-old patient with a maxillary Kennedy Class IV arch and a 49-year-old patient with a mandibular Kennedy Class I arch were rehabilitated using conventional cast removable partial dentures.

Clinical Management: All patients underwent comprehensive clinical and radiographic evaluation, diagnostic cast analysis, surveying, treatment planning, mouth preparation, definitive impression procedures, framework fabrication and evaluation, prosthetic trial, insertion, and scheduled follow-up. The design of each prosthesis was individualized according to the distribution of the remaining teeth, nature of support, biomechanical requirements, esthetic expectations, and functional demands.

Results: All three prostheses demonstrated satisfactory clinical retention, support, stability, tissue adaptation, and occlusal integration during the follow-up period. The precision attachment-retained prosthesis eliminated visible clasp display while providing satisfactory retention and function. Conventional cast removable partial dentures effectively restored anterior esthetics and function in the Kennedy Class IV patient and posterior support and mastication in the Kennedy Class I patient. All patients reported improvement in function, esthetics, and overall satisfaction.

Conclusion: Successful rehabilitation of partial edentulism depends on individualized treatment planning and appropriate prosthesis selection. Precision attachment-retained and conventional cast removable partial dentures can both provide satisfactory clinical outcomes when selected according to the biomechanical and esthetic requirements of the individual patient.

Keywords: Cast removable partial denture; precision attachment; Kennedy classification; partial edentulism; distal extension; esthetic rehabilitation; removable prosthodontics.

INTRODUCTION

Partial edentulism remains a common prosthodontic problem with consequences extending beyond the replacement of missing teeth. Loss of teeth may adversely affect mastication, phonetics, esthetics, occlusal stability, periodontal health, and oral health-related quality of life. Progressive changes such as drifting and supra-eruption of teeth, altered occlusal relationships, and residual ridge resorption may further complicate untreated partially edentulous situations.¹⁻⁴

Treatment options include tooth-supported fixed dental prostheses, implant-supported restorations, implant-assisted removable prostheses, and conventional removable partial dentures. Although implant-supported rehabilitation has substantially expanded treatment possibilities, its application may be limited by anatomical conditions, systemic

considerations, financial constraints, patient preference, or the requirement for additional surgical procedures. Cast removable partial dentures therefore continue to occupy an important role in contemporary prosthodontic practice.¹⁻⁴

Compared with conventional acrylic removable partial dentures, cast removable partial dentures incorporate a rigid metal framework that permits controlled distribution of functional forces while providing support, retention, stability, and durability. Their success, however, depends on accurate diagnosis, appropriate surveying and mouth preparation, biomechanically appropriate framework design, precise clinical and laboratory procedures, and long-term maintenance.^{1,2}

Kennedy classification provides a practical basis for understanding the biomechanical characteristics of partially edentulous arches. Kennedy Class I and Class II situations are particularly challenging because the prosthesis derives support from both teeth and the residual ridge. The difference in resiliency between the periodontal ligament and the denture-bearing mucosa predisposes distal extension bases to functional movement and rotation. Conversely, Kennedy Class IV situations are predominantly tooth-supported but frequently present considerable esthetic and functional challenges because of anterior tooth loss.^{1,2}

Precision attachments may be incorporated into removable partial dentures when conventional clasp display is esthetically undesirable. By providing retention through an interlocking mechanical system, attachments can reduce or eliminate visible clasp components. Their use nevertheless requires appropriate periodontal support, adequate interarch and restorative space, suitable abutments, precise laboratory procedures, and careful maintenance.⁵⁻⁷ Thus, precision attachments should be considered a selectively indicated treatment option rather than a routine alternative to conventional direct retainers.

The evolution of digital prosthodontics has additionally introduced digital impressions, virtual surveying, CAD/CAM design, and additive manufacturing for removable partial denture fabrication.¹³⁻¹⁷ However, technological advances do not replace the fundamental biological and biomechanical principles governing removable prosthodontic treatment. The present case series describes three distinct partially edentulous situations—Kennedy Class II Modification 2, Kennedy Class IV, and Kennedy Class I—managed using precision attachment-retained and conventional cast removable partial dentures. The cases illustrate how prosthetic design and retention strategies can be individualized according to the biomechanical characteristics, esthetic requirements, and functional needs of each patient.

CASE SERIES

General Clinical Protocol

Three patients presenting with partial edentulism were treated in the Department of Prosthodontics and Crown & Bridge, Himachal Dental College, Sundernagar.

A detailed medical and dental history was obtained for each patient, followed by extraoral and intraoral examination and appropriate radiographic evaluation. Diagnostic impressions were made with irreversible hydrocolloid, and diagnostic casts were fabricated using Type III dental stone.

The casts were surveyed to establish an appropriate path of insertion, locate favorable undercuts, assess potential abutments, and formulate the framework design. Necessary mouth preparations, including guide planes, rest seats, and required enamel modifications, were subsequently completed.

Definitive impressions were made using elastomeric impression material. Cast metal frameworks were fabricated in cobalt-chromium alloy using the conventional lost-wax technique and evaluated intraorally for complete seating, support, retention, stability, and adaptation.

Jaw relation records were obtained as required by the individual clinical situation. Following satisfactory wax trial evaluation for tooth position, esthetics, phonetics, and occlusion, the prostheses were processed using heat-polymerized acrylic resin, finished, polished, and inserted.

Patients received instructions regarding prosthesis insertion and removal, hygiene, maintenance, and adaptation. Clinical reviews were scheduled at 24 hours, one week, one month, and three months after insertion.

CASE 1

Precision Attachment-Retained Cast Partial Denture for a Kennedy Class II Modification 2 Mandibular Arch

A 50-year-old female patient reported with difficulty in mastication associated with multiple missing mandibular teeth. She additionally expressed concern regarding facial appearance and requested a prosthesis without visible metal clasps. The patient's medical history was non-contributory. Dental history revealed loss of multiple teeth secondary to caries and periodontal disease. Extraoral examination demonstrated reduced lower facial fullness and diminished lip support (Figure 1). The post-treatment extraoral appearance is shown in Figure 2.

Intraoral examination revealed a mandibular Kennedy Class II Modification 2 partially edentulous arch with moderate residual ridge resorption and satisfactory periodontal support of the proposed abutment teeth (Figure 3). Necessary abutment preparation and mouth preparation were performed before definitive prosthetic procedures (Figure 4).

Treatment Planning

The principal treatment considerations were restoration of mastication, provision of adequate support and retention, and minimization of visible retentive components. Implant-supported rehabilitation and conventional clasp-retained cast removable partial denture therapy were discussed with the patient.

Considering the patient's esthetic expectations, satisfactory periodontal support, suitable abutments, and adequate restorative space, a precision attachment-retained cast removable partial denture was selected.

Prosthetic Rehabilitation

Following abutment preparation and definitive impression procedures, the prosthesis was designed according to the biomechanical requirements of the distal extension situation.

The framework wax pattern with the precision attachment components is illustrated in Figure 5. Following casting, the framework was evaluated intraorally for complete seating, adaptation, stability, and retention (Figure 6). The attachment-prosthesis relationship was subsequently evaluated before definitive processing (Figure 7).

The completed prosthesis demonstrated satisfactory clinical retention, support, stability, tissue adaptation, and occlusal integration following insertion (Figure 8). The tissue-bearing and framework surfaces of the definitive prosthesis are shown in Figures 9 and 10. Post-insertion right and left lateral views demonstrated satisfactory intercuspation and prosthetic integration (Figures 11 and 12).



Outcome

During the follow-up period, the patient reported improvement in mastication, speech, facial appearance, lip support, and satisfaction with the absence of visible clasp display. The supporting tissues remained clinically healthy, and no attachment-related complication or prosthetic instability was detected during the observation period.

CASE 2

Conventional Cast Removable Partial Denture for a Kennedy Class IV Maxillary Arch

A 34-year-old female patient presented with missing maxillary anterior teeth and reported compromised smile esthetics, reduced incising efficiency, and reduced confidence during speech and social interaction. Her medical history was non-contributory.

The pretreatment extraoral appearance demonstrated the esthetic effect of anterior tooth loss (Figure 13), whereas the post-treatment photograph demonstrated restoration of anterior dental support and smile appearance (Figure 14). Intraoral examination revealed a Kennedy Class IV maxillary partially edentulous arch with a well-healed anterior residual ridge and satisfactory periodontal support of the remaining posterior dentition (Figure 15). The opposing mandibular dentition was also evaluated during treatment planning (Figure 16).

Treatment Planning

Possible treatment options included implant-supported prostheses, a tooth-supported fixed dental prosthesis, and a conventional cast removable partial denture. Considering the extent of the edentulous area, the desire to preserve the remaining sound teeth, financial considerations, and patient preference, a conventional cast removable partial denture was selected.

Prosthetic Rehabilitation

Following mouth preparation and definitive impression procedures, the required maxillomandibular relationship was recorded (Figure 17). The framework was designed to obtain adequate tooth support, retention, reciprocation, cross-arch stabilization, and appropriate replacement of the missing anterior teeth (Figure 18).

After successful framework evaluation and wax trial, the definitive prosthesis was processed and inserted. The seated prosthesis demonstrated satisfactory retention, stability, adaptation, and anterior tooth arrangement (Figure 19). The post-insertion frontal intraoral view demonstrated restoration of the anterior segment and satisfactory occlusal integration (Figure 20).



Figure 13. Pre-treatment extraoral photograph



Figure 14. Post-insertion extraoral photograph



Figure 15. Maxillary intraoral photograph



Figure 16. Mandibular intraoral photograph



Figure 17. Bite registration



Figure 18. Kennedy Class IV framework design



Figure 19. Occlusal view of definitive maxillary CPD after insertion



Figure 20. Post-insertion frontal intraoral view

Outcome

The patient reported improvement in smile esthetics, phonetics, incising ability, and overall satisfaction. Clinical examination during the follow-up period demonstrated healthy supporting tissues without evidence of framework distortion, clinically significant clasp deformation, or mucosal irritation.

CASE 3

Conventional Cast Removable Partial Denture for a Kennedy Class I Mandibular Arch

A 49-year-old female patient presented with bilateral posterior mandibular edentulism and reduced masticatory efficiency. Her dental history revealed multiple extractions secondary to caries and periodontal disease.

The pretreatment extraoral appearance is presented in Figure 21, and the post-treatment appearance is shown in Figure 22.

Clinical examination confirmed a Kennedy Class I mandibular partially edentulous arch. The framework was planned according to the biomechanical requirements of a bilateral distal extension prosthesis (Figure 23). The opposing maxillary dentition was evaluated as part of comprehensive treatment planning (Figure 24), and appropriate rest seat and mouth preparations were performed in the mandibular arch (Figure 25).



Figure 21. Pre-treatment extraoral photograph



Figure 22. Post-insertion extraoral photograph



Figure 23. CPD framework design on the master cast



Figure 24. Maxillary intraoral photograph



Figure 25. Mandibular intraoral photograph with rest seat preparation



Figure 26. Occlusal view of seated mandibular CPD



Figure 27. Right lateral intraoral occlusal view



Figure 28. Frontal intraoral occlusal view



Figure 29. Left lateral intraoral occlusal view

Treatment Planning and Biomechanical Considerations

Because a Kennedy Class I prosthesis derives support from both the abutment teeth and the residual ridges, control of functional rotation represented an important design consideration. Emphasis was therefore placed on broad residual ridge coverage, appropriate support from the remaining teeth, indirect retention, rigid cross-arch stabilization, and favorable distribution of functional forces.

Prosthetic Rehabilitation

Following definitive impression procedures and framework fabrication, the framework was evaluated intraorally before completion of the prosthesis. After the necessary clinical trial procedures, the definitive cast removable partial denture was processed and inserted.

The seated prosthesis demonstrated satisfactory adaptation and clinical stability (Figure 26). Post-insertion right lateral, frontal, and left lateral intraoral views demonstrated restoration of posterior support and satisfactory intercuspation (Figures 27–29).

Outcome

The patient reported improvement in masticatory efficiency and oral comfort. Supporting tissues remained clinically healthy during the follow-up period, with no significant biological or mechanical complications observed.

Comparative Analysis

Clinical Variable	Case 1	Case 2	Case 3
Age	50 years	34 years	49 years
Sex	Female	Female	Female
Kennedy classification	Class II Modification 2	Class IV	Class I
Arch	Mandibular	Maxillary	Mandibular
Principal concern	Mastication and esthetics	Anterior esthetics and function	Mastication
Prosthesis	Precision attachment-retained cast RPD	Conventional cast RPD	Conventional cast RPD
Support	Tooth–tissue supported	Predominantly tooth supported	Tooth–tissue supported
Principal design consideration	Esthetics, retention, and distal-extension biomechanics	Anterior esthetics and tooth support	Control of distal-extension rotation
Clinical outcome	Satisfactory	Satisfactory	Satisfactory

DISCUSSION

The three cases illustrate an important principle of removable prosthodontics: **similar treatment objectives do not necessarily require identical prosthetic designs**. The pattern of missing teeth, nature of available support, periodontal condition of the remaining dentition, esthetic expectations, functional demands, and patient preference collectively influence prosthesis selection.

Kennedy Class I and Class II distal extension situations present a particular biomechanical challenge because support is derived from structures with different degrees of resiliency. The periodontal ligament permits relatively limited displacement of abutment teeth, whereas the residual ridge mucosa demonstrates greater displacement under functional loading. Consequently, distal extension bases may rotate toward or away from the supporting tissues and transmit unfavorable forces to terminal abutments.^{1,2}

Established principles for managing these situations include maximizing residual ridge coverage, obtaining appropriate tooth support, incorporating indirect retention, providing rigid cross-arch stabilization, and selecting direct retainers that minimize potentially harmful torque on abutment teeth.^{1,2} These principles formed the biomechanical basis for treatment of the Kennedy Class I and Class II Modification 2 patients in the present series.

Case 1 differed from Case 3 because esthetics represented an additional major treatment determinant. Conventional clasp assemblies may be unacceptable to patients when retentive components are visible during function or smiling. Precision attachments provide an alternative method of retention that can reduce visible metal display while

establishing a defined path of insertion.⁵⁻⁷ Their use, however, requires careful evaluation of abutment periodontal support, available restorative space, interarch relationship, technical complexity, and future maintenance requirements. Burns and Ward emphasized that attachment selection should be determined by the overall clinical situation rather than esthetic considerations alone.^{5,6}

In Case 1, the combination of high esthetic expectations, suitable abutments, satisfactory periodontal support, and adequate restorative space favored incorporation of a precision attachment. The resulting prosthesis provided satisfactory clinical retention and function while eliminating visible clasp display.

Case 2 represented a fundamentally different biomechanical situation. Kennedy Class IV arches are primarily tooth-supported, and therefore the differential displacement characteristic of distal extension bases is less pronounced. The major treatment challenges in this patient were restoration of anterior dental esthetics, phonetics, incising function, and appropriate prosthetic contour. A conventional cast removable partial denture permitted replacement of the missing anterior teeth while avoiding extensive preparation of the remaining sound teeth.

Case 3 demonstrates the continued relevance of conventional clasp-retained cast removable partial dentures for bilateral distal extension situations. The design emphasized broad tissue support, indirect retention, rigid framework components, and controlled distribution of functional forces. The satisfactory clinical outcome indicates that conventional designs remain effective when fundamental biomechanical principles are appropriately applied.

Taken together, the cases demonstrate that precision attachments should not be considered universally superior to conventional clasp retention. Instead, each represents a treatment modality with specific indications. Precision attachments may provide a distinct esthetic advantage in appropriately selected cases, whereas conventional clasp-retained frameworks generally offer simpler fabrication, easier maintenance and repair, and predictable clinical performance.^{2,5-7}

Implant-assisted removable partial dentures provide another treatment option for distal extension situations. Placement of strategically positioned implants beneath a distal extension base can increase support and reduce prosthesis displacement, effectively altering the biomechanical behavior of the prosthesis.⁹⁻¹¹ Nevertheless, implant placement may be restricted by anatomical, systemic, surgical, financial, or patient-related considerations. Removable partial dentures therefore remain clinically relevant even in contemporary implant-oriented practice.

Digital technologies have also modified the fabrication of removable partial dentures. Digital impressions, virtual surveying, CAD/CAM framework design, selective laser melting, direct metal laser sintering, and other additive manufacturing methods have demonstrated encouraging levels of accuracy and reproducibility.¹³⁻¹⁷ However, digital fabrication changes the method by which the prosthesis is produced rather than the biological principles governing its design. Appropriate support, retention, stability, reciprocation, stress control, and maintenance remain essential regardless of whether the framework is conventionally cast or digitally manufactured.

A notable feature of this case series is the inclusion of three different Kennedy classifications treated using two different retention philosophies. This permits comparison of the clinical reasoning underlying prosthesis selection and emphasizes that successful removable prosthodontic rehabilitation requires adaptation of established principles to the individual clinical situation.

The report is limited by the small number of patients and relatively short follow-up period. Consequently, conclusions regarding long-term prosthesis survival, attachment wear, maintenance requirements, periodontal changes, or biological and mechanical complications cannot be drawn. Furthermore, standardized patient-reported outcome measures and objective measures of masticatory performance were not employed. Future prospective studies incorporating larger patient cohorts, longer follow-up, and validated patient-reported and functional outcome measures would provide stronger evidence regarding the comparative performance of these treatment approaches.

Clinical Significance

Partially edentulous arches with different Kennedy classifications present distinct biomechanical and esthetic challenges. Prosthesis design should therefore be based on the nature of support, distribution and condition of the remaining teeth, residual ridge characteristics, esthetic requirements, functional demands, and patient preference. Precision attachments can provide an esthetically favorable retentive option in appropriately selected patients, particularly when visible clasp display is undesirable. Conventional cast removable partial dentures, however, remain predictable and clinically relevant for both tooth-supported and distal extension situations when designed according to established biomechanical principles.

The cases presented demonstrate that **individualized prosthesis selection, rather than reliance on a single retention philosophy, is central to successful removable prosthodontic rehabilitation.**

CONCLUSION

Within the limitations of this case series, successful rehabilitation was achieved in Kennedy Class I, Class II Modification 2, and Class IV partially edentulous arches using individualized cast removable partial denture designs. The precision attachment-retained prosthesis provided an esthetically favorable solution for the patient with high esthetic expectations while maintaining satisfactory clinical retention and function. Conventional cast removable partial dentures provided satisfactory restoration of anterior esthetics and function in the Kennedy Class IV patient and posterior support and mastication in the Kennedy Class I patient.

These cases emphasize that the choice between precision attachment-retained and conventional clasp-retained prostheses should be guided by clinical indication rather than by the assumption that one retention system is universally preferable. Accurate diagnosis, appropriate case selection, sound biomechanical design, meticulous clinical and laboratory execution, and continued maintenance remain the principal determinants of successful removable partial denture therapy.

Long-term prospective studies incorporating larger patient populations, standardized clinical parameters, patient-reported outcome measures, and objective functional assessments are required to further evaluate the performance of these treatment approaches.

Declaration of Patient Consent

The authors certify that appropriate patient consent was obtained for the use of clinical information and photographs for scientific publication. The patients were informed that their names and initials would not be published and that reasonable efforts would be made to conceal their identities; however, complete anonymity cannot be guaranteed.

Conflict of Interest

The authors declare no conflicts of interest related to this manuscript.

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