



CAST PARTIAL FRAME WORKS WITH FLEXIBLE DENTURE BASES: REVIEW AND CASE SERIES

Prosthodontics

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ABSTRACT

Flexible denture bases combined with cast partial frameworks represent an innovative approach for managing partially edentulous arches, offering improved aesthetics, retention, and patient comfort. This review and case series highlight the advantages, materials, and clinical applications of flexible dentures. Thermoplastic resins, including polyamides and polycarbonates, provide enhanced flexibility, biocompatibility, and translucency, making them ideal for aesthetic and functional restorations. However, these materials have limitations such as discoloration, surface roughening, and difficulty in repair. The article details two cases where flexible denture bases with cast frameworks effectively restored multiple edentulous areas. Strategic planning, including the use of occlusal and cingulum rest seats, antero-posterior straps, and lingual plates, ensured vertical force transmission, cross-arch stabilization, and enhanced hygiene. Injection moulding techniques facilitated precise adaptation, resulting in reduced mobility and improved mastication. The discussion emphasizes the benefits of flexible dentures in utilizing undercuts, maintaining peripheral seals, and preventing ridge resorption, especially in anterior aesthetic regions. This study underscores the clinical utility and challenges of integrating flexible materials with cast partial frameworks, advocating for their thoughtful application in prosthodontic treatment.

KEYWORDS

Flexible Denture, Cast Partial Denture.

INTRODUCTION

A Removable denture that replaces some teeth in a partially edentulous arch; the removable partial denture can be readily inserted and removed from the mouth by the patient¹. Partially edentulous situations are not uncommon in middle age and elderly individuals. Most common edentulous areas are missing mandibular first molars. Different classification is suggested for easy planning of treatment and subsequent placement of prosthesis. Untreated Partially edentulous arches will lead to malocclusion, supra eruption, recession, loss of dentoalveolar support and other effects on the masticatory system. Mouth preparations such as oral surgical procedures and restorations considered to be important prior to restorative plan. Diagnostic mounting of maxillary and mandibular partially edentulous casts will help in assessing and understanding occlusal plane, lingual occlusion, edentulous space².

Treatment of partially edentulous arches with cast frame works will require meticulous planning and appropriate clinical steps contributes to increase stability and better adaptation. Removable partial dentures usually take support from edentulous tissues and teeth hence preparation of functional bearing tissues and assessment of periodontal health is considered as a important before taking impressions³. Oral prophylaxis, gingival health, identification and treatment of incipient and other carious lesions, occlusal coverage, cervical root caries restorations and crowns will give raise to occlusal stability and favourable occlusal plane. Castable Clasp placement for direct retention requires retentive areas and parallel surfaces and extensive occlusal coverage will lead to unesthetic outcome³. Cast partials with gingivally placed flexible clasps on teeth and extensive coverage with denture bases will improve retention and esthetics. Strategic planning of rests and rest seats placed on teeth will transmit forces vertically for long term success. Unilateral and bilateral edentulous areas with modification spaces will benefit proper planning of cast partial with flexible clasps. Cast partials having flexible clasps especially useful in excessive recession tooth surface areas and multiple missing teeth edentulous situations. Anterior edentulous regions would receive flexible dentures successfully without much relief and adjustments².

Material and its Properties

Thermoplastic resins which become pliable or mouldable above a specific temperature and return to a solid state upon cooling are used for the fabrication of flexible dentures. There are different kinds of thermoplastic resins available viz. Polyamide, Acetal, Polyesters, Polycarbonate Polypropylene, Acrylic⁴.

Denture wearers, both men and women, are highly concerned about the aesthetic appearance. With flexible dentures it is possible for the retentive parts to actively utilize a vital tooth, increasing the opportunities for both patients and dentists to choose RPDs.

More acceptable aesthetics, since there are no metal clasps. Translucency of the material picks up underlying tissue tones, making it almost impossible to distinguish in the mouth. The material is exceptionally strong and flexible. Free movement is allowed by the overall flexibility. Therefore, even if there is a little bit of bending, it comes back to the original shape and position.

The resins currently in use have a lower elastic modulus and a softer surface compared with acrylic resin, meaning that patients feel better when worn. There also appears to be no problem with fit. As there is a low risk of breakage of dentures which are highly elastic and not at all rigid, the denture base can be made thinner. This makes them lighter and thinner than RPDs using an acrylic resin or metal framework to ensure rigidity. Ease of insertion in the mouth with alveolar undercuts because of the flexibility.

Complete biocompatibility is achieved because the material is free of monomer and metal, these being the principal causes of allergic reactions in conventional denture materials. Flexible dentures will not cause sore spots due to negative reaction to acrylic resins and will absorb small amounts of water to make the denture more soft tissue compatible.

Flexible dentures tend to absorb water content and tend to discolour very often. Surface roughening after a few months of denture delivery was identified. As the surface is not as hard as that of acrylic resin, the depths and the widths of marks were greater than in the acrylic resins by the scratch test, thus the polished surface loses its lustre.

Debonding of acrylic teeth from nylon denture base since teeth in these flexible dentures are bonded mechanically (diatorics) and not chemically. It does not conduct heat and cold like metal. The resin clasp covers the cervical area of the abutment teeth over a wide area on both the crown and root sides, being designed to be part of the gingiva. This means that the area covered by the resin clasp is large, and the undercut and relief regions may easily become dead space, with the risk of exacerbating periodontal conditions. Meticulous cleaning is therefore essential. Breakage of retentive elements from denture is not uncommon⁴. Mobile teeth are not splinted by flexible dentures. Flexible denture is very hard to repair if fractured. No additions can be

made onto it. In such cases, rebasing is recommended.

Lacks important elements of conventional RPD like occlusal rests and rigid framework hence transmission of functional load is not very efficient. Requires more chair-side time for adjustment. Requires special instruments (knives and polishing kit) to make the adjustment. When grinding this prosthesis, proper ventilation, masks and vacuum systems should be used and the procedure is technique sensitive⁴.

Case 1

Partially edentulous with modification spaces observed and assessment, mouth preparation done for planning cast partial denture with flexible denture bases (Figure 1,2,3).



Figure 1



Figure 2



Figure 3

Primary Impressions were made with Alginate impression material and diagnostic casts obtained, bases were poured with type 2 dental plaster and preliminary surveying was done. Mouth preparations such as adjustments of proximal surfaces to decide path of insertion and path of removal, analysing the extent of retentive areas on the potential abutments' teeth, strategic rest seat preparations were performed before planning of impression procedures². This was followed by elastomeric impression with putty wash technique⁵. The impression poured with type 4 dental stone and block-out was done in order to accommodate antero-posterior palatal strap in relation to maxilla along with distal occlusal rest seat preparation in relation to 15 and mesial occlusal rest seat preparation in relation to 25. In the mandible a lingual plate major connector was used with distal occlusal seat preparation in relation to 45.

The metal framework was fabricated using lost wax technique which includes duplication of the master cast with invest material and casted with base metal alloys and trimmed and seated accordingly and final jaw relations were established in relation maxilla and mandible. Teeth arrangement was done using anatomic teeth and retentive depressed areas created on ridge lap areas of teeth for added mechanical retention. The holes are made for mechanical retention of acrylic teeth to flexible denture base. The holes may be made before arranging teeth or removing the teeth from the mould after dewaxing⁷. The wax should be completely removed from the holes in the teeth. If wax is not completely removed from holes, flexible material may not flow properly into holes from the cartridge, thereby affecting the retention of teeth with denture base. This technique of retention of acrylic teeth with flexible denture base is known as Retento-Grip tissue bearing technique⁷.

Arrangement of the teeth, try in and wax up and attachment of the sprue formers to make the channels for flowing of fluid resin into mould was done. Prefabricated sprue formers were attached. After investing in a special flask designed for injection moulding technique, dewaxing was done by placing flasks in boiling water for 3 to 5 minutes to soften the wax. Check the flask margin and ensure that both flask halves fit together with intimate metal contact.

A suitable cartridge was selected and placed in cartridge carrier which is then placed in electric cartridge furnace used for softening of flexible denture base material. The application of spray prevents adhesion of cartridge with cartridge carrier and allows smooth separation.

The material should be plasticized for 15 to 20 minutes at 550 to 560°F (Valplast). Maintain this temperature for 15 to 20 minutes. Remove the

cartridge from the electric furnace and place it on the inlet of the flask and compress the mechanical compressor. The time between removing the cartridge assembly from the furnace and injection should be less than 1 minute. If longer, the cartridge will begin to cool and may result in partial or no injection. The pressure should be maintained for 3 to 5 minutes. The pressure was then relieved and the flask was allowed to bench cool for at least 15 to 20 minutes before opening.

The material flows through the sprues into the mould. The flasks should not be opened immediately to prevent distortion of the prosthesis. The injection pressure should be 100 psi (minimum 75 psi) and injection time should be 1 minute.

The finishing procedure used for flexible partial denture is different from finishing of acrylic resin prosthesis. The acrylic instruments should not be used because they generate heat and cause fibre formation and roughness of the prosthesis. Being thermoplastic material, the high heat generated while finishing with acrylic trimmers may soften and distort the prosthesis. The sprue formers are cut with special type of knife or disk and finishing is done with vulcanite burs and green and pink mounted stones, usually used for porcelain finishing, using a rapid and light shaving motion.

The staining resistance of the prosthesis depends on its shiny/lustrous appearance. The surface of prosthesis should be highly shiny without any roughness to resist the staining. The polishing of flexible partial dentures is done in different steps after cutting the sprues and finishing. The first step is polishing with pumice or pumice substitute. Mix the pumice with water, place on prosthesis and polish with the help of buff. Meticulous planning with appropriately selected abrasives with coolant will give smooth and shiny finish which improve the longevity of prosthesis. To maintain the shine of the prosthesis, it is important to clean the prosthesis daily after every meal. Finally, high lustre shine is achieved by polishing with polishing cake. Polishing cake is used with dry buff to develop highly bright/lustre surface⁷.



Figure 4



Figure 5



Figure 6



Figure 7

Case 2



Figure 8



Figure 9



Figure 10

Partially edentulous arches with several missing teeth were selected for planning and placement of cast partial with flexible denture bases

(Figure 8,9,10). Primary impressions were made using alginate impression material for both maxilla and mandible and base was poured with type 2 dental plaster⁵. This was followed by surveying of the cast with the help of the surveyor and marking the undercuts and surveying lines. This was followed by elastomeric impression with putty wash technique and poured with type 4 dental stone Block out was done in order to receive antero-posterior palatal strap in relation to maxilla with occlusal seat preparations in relation to 13, 23 (cingulum rest seat preparation), Rest seat preparation in 15, 24.



Figure 11

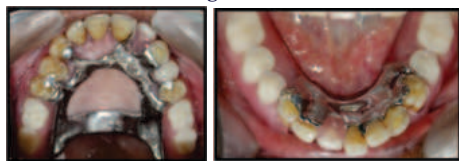


Figure 12

Figure 13

In the mandible the major connectors used is lingual plate cingulum rest in relation to 33 and Mesial occlusal rest in relation to 34. This was followed by duplication of cast and casting was done with base metal alloys using lost wax technique and trimmed and seated and all the steps for fabrication of flexible denture (Figure 14)



Figure 14

DISCUSSION

Cast partial denture frame work with flexible denture base presents with reduced mobility and improved masticatory function. Cast partial denture clasp arms fracture very frequently because of excessive stress and long usage. Flexible clasps will improve aesthetics and fracture resistance and enhances retention. Multiple edentulous modification spaces successfully restored with flexible denture bases. (Figure 2 & 3) External and Internal finish line on the cast partial frame works with flexible material adapted will improve hygiene and aesthetics. Rest and rest seats placed on the occlusal surfaces transmit occlusal forces vertically and improves strength to prosthesis. Proximal plate, palatal adaptation of metal framework gives the cross-arch stabilisation and bracing effect which prevents horizontal mobility of prosthesis. Smooth finished lingual flange contour will be favourable to floor of mouth and compatible to edentulous ridge (Figure 6 & 7). Properly adapted flexible denture bases will maintain peripheral seal and overall improvement in retention of prosthesis. Buccal and labial undercuts of edentulous ridges are successfully utilised with flexible denture bases, prevents Residual ridge resorption, and protects the abutment teeth (Figure 4, 5 & 13). Proper adaptation of lingual embrasures with lingual plate provides indirect retention and hygiene maintenance (Figure 5 & 13). Aesthetics in the anterior region improved with very well adapted flexible denture flanges which covers display of metallic structure and give raise to pleasing appearance of prosthesis (Figure 11).

Several studies have highlighted the aesthetic and functional benefits of using flexible denture bases in conjunction with cast partial frameworks. Sayed et al. (2020) demonstrated that flexible dentures enhance patient comfort, improve retention, and utilize undercuts effectively, providing a more stable prosthesis. Furthermore, their translucency allows them to blend with natural tissues, offering a

superior aesthetic advantage compared to conventional RPDs⁸.

Flexible dentures primarily employ thermoplastic resins such as polyamides and polycarbonates. Gupta et al. (2012) underscored the biocompatibility of these materials, highlighting their low elastic modulus, which improves patient comfort. Additionally, injection moulding techniques have allowed precise adaptation of flexible materials, making them ideal for cases with complex undercuts. Materials like acetal have been shown to provide better dimensional stability while maintaining flexibility, ensuring a longer prosthesis lifespan⁷.

Flexible dentures have proven particularly useful in cases involving anterior aesthetics or extensive edentulous regions. According to Nair et al. (2019), these dentures reduce residual ridge resorption due to their adaptability and reduced stress transmission. Clinical applications often emphasize their role in reducing mobility and improving mastication in complex edentulous scenarios. Proper integration with cast metal frameworks ensures cross-arch stabilization and long-term durability⁴.

Despite their advantages, flexible dentures present certain challenges. Surface roughness and discoloration over time have been noted, especially with polyamide-based dentures. Additionally, Singh and Gupta (2012) highlighted issues such as difficulty in repair and debonding of acrylic teeth from the denture base. These limitations necessitate meticulous planning and patient education to ensure long-term success⁷.

CONCLUSION

The integration of flexible denture bases with cast partial frameworks presents a versatile and patient-centred approach for managing partially edentulous cases. By combining the structural stability of cast metal frameworks with the aesthetic and flexible properties of thermoplastic materials, this treatment modality addresses both functional and aesthetic demands effectively. Flexible dentures offer several benefits, including improved retention, patient comfort, and utilization of undercuts, while minimizing visible metal components for enhanced aesthetics.

However, their limitations, such as discoloration, surface roughness, and challenges in repair, must be considered during treatment planning. Proper case selection, meticulous clinical and laboratory procedures, and attention to hygiene maintenance are critical for long-term success. This manuscript demonstrates that flexible denture bases with cast frameworks can provide an optimal solution for complex edentulous scenarios, contributing to better oral health outcomes and patient satisfaction.

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