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Contemporary approaches for Preventive management of compromised residual dentition “Three clinical case reports”

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Abstract
Prosthodontics is one of the substantial pillars of preventive dentistry. The most functional prosthetic prophylaxis is the prevention of causes leading to tooth extractions and the prevention of alveolar bone loss after some teeth are extracted. Sometimes, elderly patients prefer to keep their natural teeth but avoid removable partials; however, Ideally, patients should not be rendered edentulous late in life as they are unlikely to adapt to complete denture limitations. This case series presents preventive management approaches of three challenging cases restored successfully by modern forms of removable partials enrolling different attachment types, aiming to salvage the compromised residual dentition, and carefully manage the transition to the edentulous state in a gradual manner. The attachments were selected based on each patient’s related factors as determined after comprehensive clinical, radiographic, and mounted cast assessments. Patients expressed satisfaction with their prostheses regarding retention, stability, esthetics, function, hygiene, and ease of insertion and removal.

Keywords: Preventive prosthodontics, Attachment retained partial dentures, OT reverse 3 extracoronal attachment, OT equator pivot attachment, Telescopic partial dentures

1. Introduction

The loss of several teeth doesn’t have to be an immediate threat to the function of the whole dentition, but it can initiate serious problems related to the oro-facial region and the well-being of the patient. From this perspective, prosthetic dentistry is a valuable tool with high therapeutical and preventive character. The main goals of preventive prosthodontics are; to assess the need for early prosthodontic replacement of lost teeth which delays further teeth loss and residual ridge resorption, and to design prostheses that do not interfere with normal oro-dental health and hygiene [1, 2].

Tooth loss in older patients is conventionally addressed with removable partial dentures (RPDs) which have many drawbacks and limitations. However, the success of a full-arch restoration requires a decisive balance between modern and conventional techniques. Attachment-retained RPDs can be considered such a type of rehabilitation, particularly the extracoronal ones that are deemed more efficient [3]. The use of telescopic attachments also offers ideal prosthetic options that facilitate access for cleaning and allow retaining questionable teeth longer with the advantage of splinting and retention similar to fixed prostheses, it also transmits occlusal forces along the long axis of the teeth [4]. When it comes to extended edentulous spans, RPDs extensively lose their direct-indirect retention and support, they would be subject to rotations and tipping. Preserving some roots in these spans is valuable for; improving support, minimizing alveolar resorption, and maintaining proprioception. Those roots also can be incorporated into the design of removable partial overdenture (RPOD) as an anchor to improve retention and stability using various precision attachments [5].

No specific reports focusing on the preventive prosthetic management of compromised residual dentition using modern forms of RPDs have been published yet, thus this case series aimed to describe variable preventive techniques for three patients' rehabilitation with removable prostheses enrolling different types of attachments.

Case reports

Case 1

A 45-year-old female patient presented to the clinic complaining of poor appearance due to extensive teeth loss. The patient presented with a single, grade I mobile canine in the maxillary left quadrant and heavily restored first premolar and first molar teeth in the maxillary right quadrant against an edentulous mandibular arch. The patient expressed a strong desire to keep her remaining teeth and to have well-retained, and esthetic dentures. patient's history didn't signify to have an impact on future dental treatments. Radiographs of the remaining teeth revealed favorable bone support and crown-root ratio. Intraoral examination revealed well-formed ridges in class I relation, and a deep maxillary labial undercut. Following periodontal, endodontic, and restorative treatments, preliminary impressions were made and occlusion blocks were fabricated to take a tentative centric relation for mounting the diagnostic casts. Examination of the articulated models revealed; limited vertical space in the canine region, tipping, and over-eruption of the premolar and molar abutments. The patient was presented with various treatments, after an explanation of each option in terms of procedures, cost, and time, the patient consented to the fabrication of attachment-retained maxillary RPOD against a mandibular complete denture.

The canine was de-coronated leaving a 2mm coronal portion that was rounded to a nicely contoured dome. The low-profile OT equator pivot attachment (OT equator titanium-tin coated pivots, Rhein 83, Bologna. Italy) was selected to suit the limited restorative space. (Fig.1a) Peeso reamers and the attachment-specific drill (Mooser bur for pivots, Rhein 83) were used for preparing the post space to the calibrated optimum length of the attachment post, then the attachment pivot was installed and cemented with resin cement (G-CEM self-adhesive luting cement, Germany). Regarding the posterior teeth, they were prepared to receive porcelain fused to metal (PFM) fixed partial denture (FPD) in conjunction with an extracoronal attachment (OT reverse 3 extracoronal attachment, Rhein 83). (Fig.1b) A two-stage putty-light impression of the prepared teeth was obtained. (Zhermack Elite HD+ putty soft and Light Body, Zhermack SPA. Italy) (Fig.1c & d) The impression was poured in die stone, and casts were mounted based on the obtained centric record. (Fig.1e) The wax pattern of the FPD was fabricated for the prepared posterior teeth, and the attachment castable arm was attached to the first premolar crown; thus, was roughly cantilevered to the right-side canine region, permitting bilateral symmetrical distribution of prosthesis retention. After cast metal FPD try-in and ceramic layering, the attachment titanium nitrite retentive female was bonded to the corresponding calibrated hole of the attachment cast arm. (Fig.1f)

The FPD was temporarily cemented and a single-stage putty-wash pickup impression was made in a border-molded custom tray, while the housing cap of the canine equator was in place over its patrix. The master cast was poured, modified, and duplicated into a refractory cast to build up the wax pattern of the RPOD framework employing the OT reverse 3 castable monobox. (Fig.2a) The cobalt-chromium framework was fabricated with an open window around the equator cap location to later permit direct chairside pickup of equator prosthetic components. The framework design included circumferential bracing arms to fit the lingual crown ledges on the FPD, a combination denture base, and a palatal plate major connector. (Fig.2b)

After a satisfactory framework try-in, subsequent procedures were similar to the fabrication of conventional dentures. At the denture insertion visit; (Fig.3a&b) the OT reverse 3 retentive male was installed into its cast housing inside the processed denture fitting surface, and the FPD was permanently cemented. The equator housing was seated in place over the canine, and the denture intaglio was further relieved to ensure passive seating before chairside pick-up with auto-polymerizing acrylic resin. (Fig.3c) (Dura-Liner II, Dental Mfg Co., Keliance). Before delivery, the occlusion was checked and occlusal discrepancies were corrected. (Fig.3d)

Case 2

A 52-year-old male presented to the clinic, complaining of incompetent masticatory function after teeth loss. He had never worn a denture before and he didn't report any relevant medical history. Clinical examination revealed the presence of few remaining teeth with favorable bone support and crown-root ratio as verified by radiographic examination, they were tooth numbers (13, 23, 27, and 43). Maxillary and mandibular ridges were in class I ridge relationship, and the maxillary ridge exhibited deep labial undercuts. (Fig.4a)

After thorough examinations, and assessment of articulated casts, the possible prosthetic treatments were presented to the patient including; extraction of the remaining teeth for conventional complete dentures or implant prostheses versus their enrollment in tooth-supported /attachment-retained restorations. The patient desired to have a retentive and esthetic restoration with minimal cost and without extraction of the remaining teeth, so we came up with a plan to fabricate attachment retained prosthesis in the maxilla against mandibular overdenture. Both maxillary canines and the lonely standing mandibular canine were endo-treated and prepared to function as overdenture abutments, the maxillary canines were prepared for the installation of OT equator-pivot attachments, (Fig.4b) and the maxillary right second molar was prepared to receive a PFM crown anchoring an OT reverse 3 extracoronal attachment. (Fig.4 c & d)

The clinical and laboratory procedures followed the same as mentioned in the previous case, RPOD framework design included; a circumferential bracing arm to fit the second molar lingual crown ledge, a combination denture base, and a palatal plate major connector. (Fig.5)

The processed denture was designed with an open-face labial flange to guard against excessive labial fullness that accompanies undercuts block-out, (Fig.6a&b) equator attachment retentive components were similarly incorporated into the denture by direct chair-side pickup, and dentures were delivered to the patient after performing needed occlusal adjustments. (Fig.6c&d)

Case 3

A 65-year-old male presented to the clinic, suffering from incompetent mastication due to the loss of entire natural dentition except for a few mandibular teeth (the left canine, and the right side; canine, first, and second premolars). Those teeth exhibited marked attrition but no mobility. Their radiographic examination revealed optimum bone support. The patient requested a removable but adequately retained prosthesis without extraction of what is left. Following comprehensive assessments, endodontic therapy was carried out for the remaining teeth, and a telescopic hybrid prosthesis with PFM crowns was planned to rehabilitate the mandibular arch against a maxillary complete denture.

Teeth were prepared to receive the primary copings, occlusal clearance was checked using the tentative bite record (Fig.7a), and a laboratory-customized clear acrylic stent was used to guide and control the axial reduction. (Fig.7b&c)

After impression-making and cast scanning, primary copings were digitally designed and printed in wax, the wax copings were surveyed to verify their parallelism (Fig.8a&b), and after their casting further milling was done on the surveyor using a two-degree tapered milling bur. (Fig.8c) After a satisfactory try-in, the primary copings were permanently cemented. (Fig.8d)

The final impressions were obtained for both arches in border molded special trays, (Fig.9a) the mandibular cast was modified and duplicated into a refractory cast to build up the telescopic retained RPD framework wax pattern. The cast metal framework was tried in the patient's mouth for fit and retention, (Fig.9b) after which occlusion rims were added, and the casts were mounted according to a face bow transfer and centric relation record. (Fig.9c&d)

Ceramic veneering of framework secondary crowns, and an aesthetic try-in were carried out before denture teeth arrangement. The waxed-up dentures were checked for esthetics, phonetics, and balanced occlusion. Dentures were processed conventionally in heat-cured resin, (Fig.10 a&b) and were delivered to the patient after verifying fit, retention, stability, and occlusal contacts in centric and eccentric movements. (Fig.10c)

All patients were given instructions on prosthesis care and hygiene maintenance. They were instructed regarding the insertion and removal of the denture in the proper path and also instructed to achieve snap-in /or frictional retention by using only finger pressure without the aid of the opposing teeth, and learned how to care for the inserts and the retention elements. They were given appointments for routine follow-ups (the next day, after one week, two weeks, and then every month for three months). It is worthy of reporting that patients expressed satisfaction with their attachment retained prosthesis immediately after delivery, and during follow-up visits, especially regarding the retention, stability, ease of cleaning, insertion, and removal.

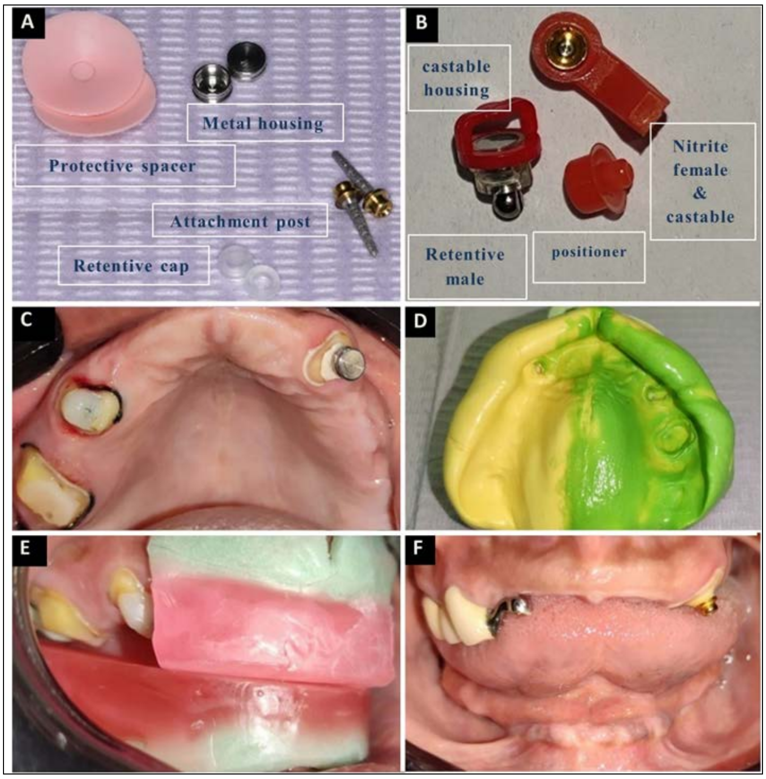

Fig 1: Attachment fabrication and installation in sequence; components of selected attachments (A; Equator &B; OT reverse 3), teeth preparations and equator attachment installation (C), two-step putty-light impression (D), obtaining jaw relation record (E), intraoral view of the FPD & attachments (F).

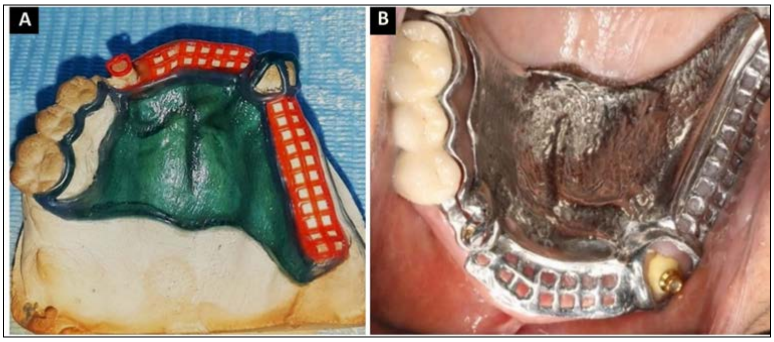

Fig 2: RPOD metal framework fabrication and try in; framework wax pattern on the refractory cast (A), intraoral fitting of the cast framework (B).

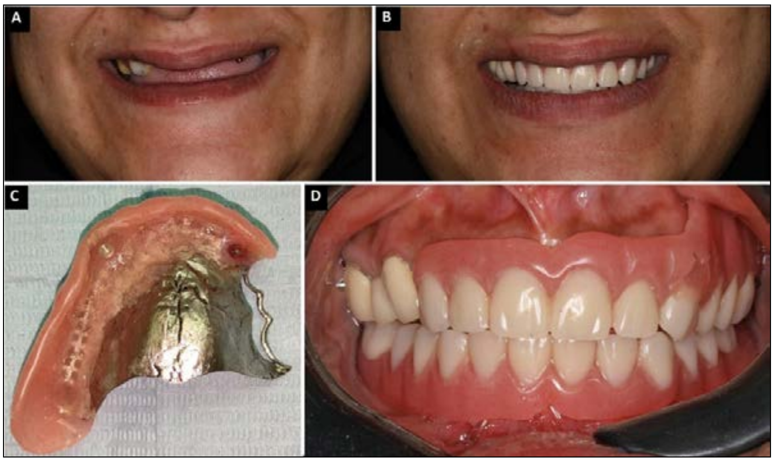

Fig 3: Pre-and post-prosthetic rehabilitation (A&B), equator housing pickup(C), and dentures insertion (D).

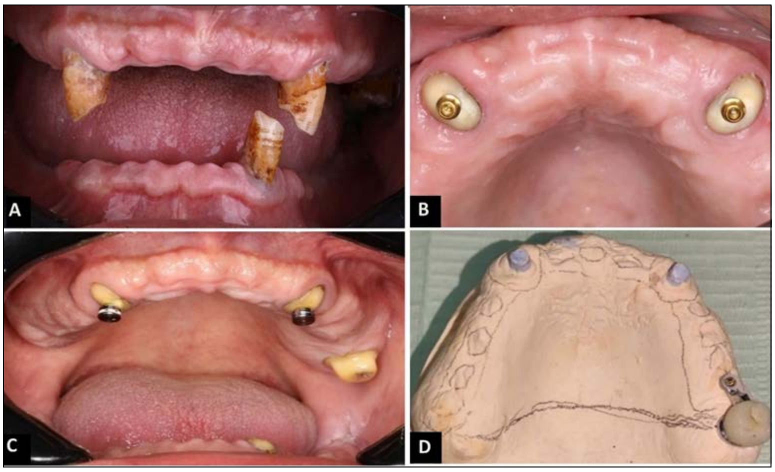

Fig 4: Situation before and after teeth preparations to receive the selected attachments; Preoperative assessment(A), equator attachments installation (B), and molar reduction for extraconal attachment fabrication (C&D)

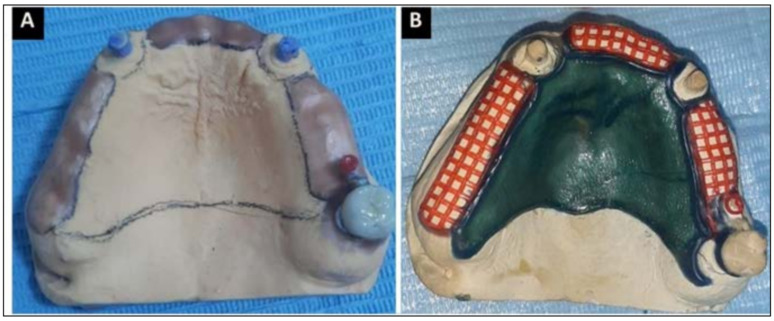

Fig 5: RPOD framework fabrication; master cast modifications (A), and RPOD framework wax pattern. (B)

Fig 6: Pre-and post-prosthetic rehabilitation (A&B), dentures insertion (C&D).

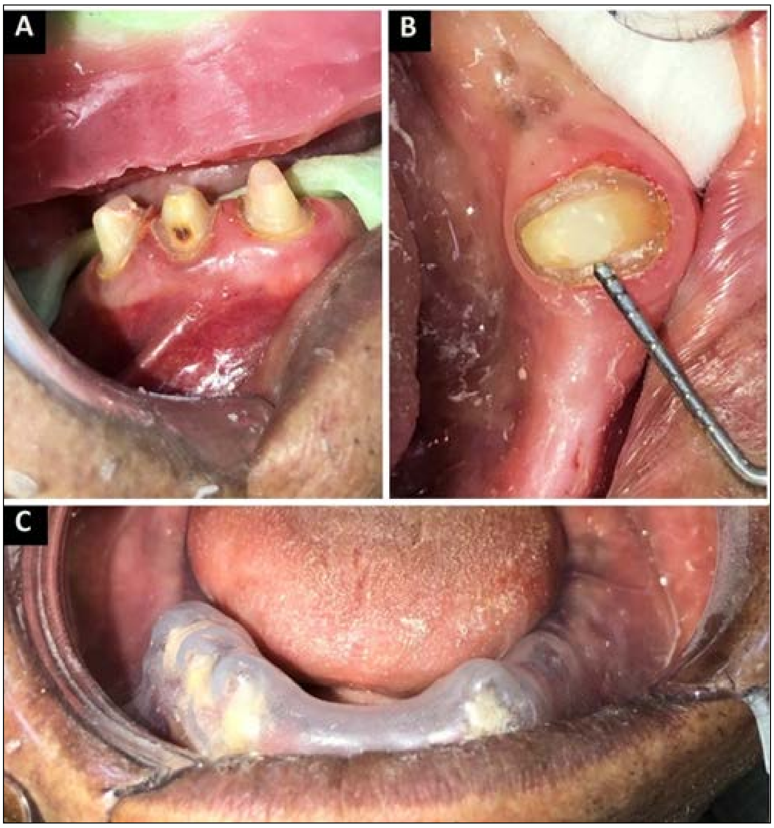

Fig 7: Guided occlusal (A), and axial reduction (B & C) of remaining teeth.

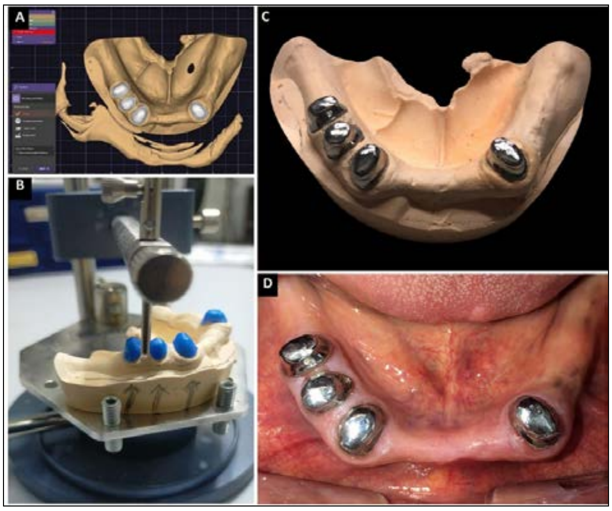

Fig 8: Primary copings fabrication and cementation; digital designing (A), refining CAD/CAM wax patterns on the surveyor (B), cast metal primary copings (C), and their intraoral cementation (D).

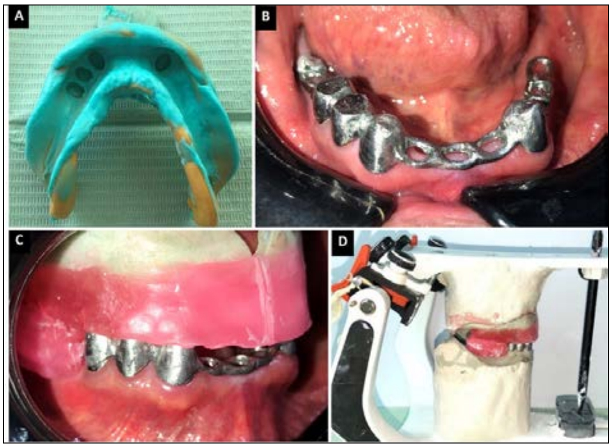

Fig 9: Framework fabrication and obtaining the jaw relation record; final impression over primary copings (A), telescopic retained metal framework try-in (B), jaw relation, and mounting (C&D).

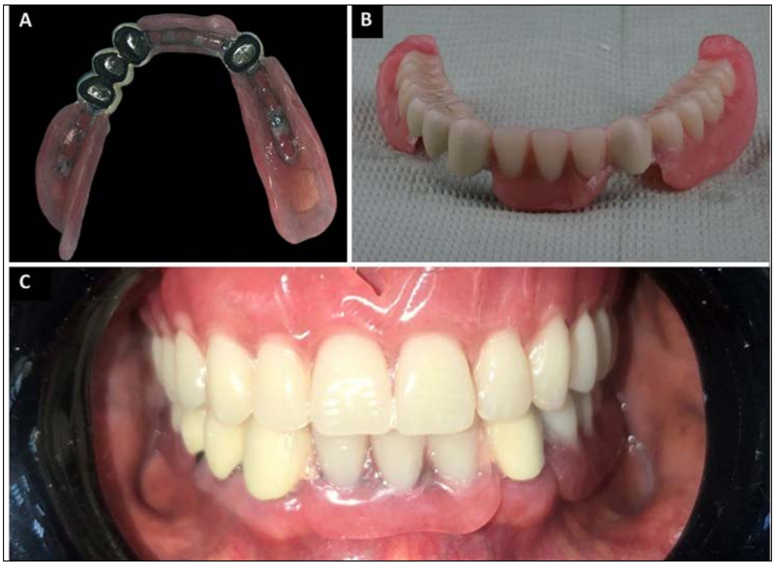

Fig 10: Final prosthesis; fitting surface (A), occlusal surface (B), and intraoral denture insertion (C).

Discussion

Preventive prosthodontics emphasizes the importance of any procedure that can delay or eliminate future prosthodontic problems, and treating partially edentulous patients has become a routine part of our daily clinical practice. In this perspective, every effort should be made to salvage the remaining teeth to contribute to the gradual transition from natural dentition to complete dentures [1, 2]. In these cases, the teeth were retained and enrolled as dentures were constructed, this optimized dentures' support, retention, and stability; and jointly the teeth prognosis was enhanced, bone resorption was inhibited and proprioception was maintained. Implant-retained prostheses could be an effective alternative to RPDs but, may be beyond the financial resources of many older people, compromised systemic conditions and fear of surgery among older patients may also be a barrier to this treatment approach [6].

De van [7] stated, "The patient's fundamental need is the continued preservation of what remains of chewing apparatus rather than the meticulous restoration of what is missing". Therefore, our ultimate goal during partial denture construction was to minimize forces transmitted to abutments and other supporting structures and to optimize stress distribution between them. That's why rigid metal frameworks with stabilizing arms and extended palatal connectors were designed, and resin denture bases were widely extended to cover the maximum area as determined by the function of border tissues. Moreover, retaining and incorporating the roots in the RPOD design decreased the dependence on tissue support and reduced the detrimental denture movements by changing the fulcrum line axis position [8]. and there is evidence that reducing the effective crown/ root ratio of teeth used as overdenture abutments has a direct impact on decreasing mobility, giving the abutment more resistance to oral forces, and improving the compromised abutment's periodontium [9]. Furthermore; using full-coverage crowns, and telescopic copings offered protection for the abutments from the hassles of the oral environment, Over and above, the FPD and the telescopic RPD frameworks provided adequate splinting for the abutments; all this hopefully could increase their life expectancy.

Articulated diagnostic casts were used as an important aid for the evaluation of; the restorative space available for the attachments, and the existing occlusal plane regularity. Sufficient space must exist all around for the selected attachments to be surrounded by a reasonable acrylic resin thickness without weakening the denture base [5]. In terms of space requirements, the selected attachments have a significant advantage in that; the equator has a low (2.1 mm) profile and the OT3 extracoronal attachment is characterized by its reduced dimensions, thus they didn't block proper teeth arrangement and didn't encroach upon the denture flanges or the occlusal vertical dimension [10]. Modification of existing teeth occlusion was essential because the tipped occlusal plane of natural teeth would dictate the opposing artificial occlusion, thus in these cases the over eruption, tipping, and rotation of the remaining teeth were addressed by the full coverage crowns or copings for partial denture abutments and total decoronation of overdenture abutments [5, 8].

Precision attachment retained RPDs facilitate the esthetic and functional replacement of missing teeth, here The OT3 reverse extra coronal attachment offered several advantages; besides its small size, the castable attachment arm was simply cast with the crowns used to protect and restore the abutment's occlusion, concurrently, the retentive female is a prefabricated titanium-nitrite component, it was bonded to its corresponding bed in the cast arm only after porcelain packing, thus not exposed to any of the risks associated with the laboratory fabrication procedures and ceramic firing, this significantly improves the retention and the durability of the attachment. Furthermore, the retentive attachment male is a split stud made from titanium, embedded in a soft nylon matrix, which increases attachment resiliency thus reducing the problems related to wrong denture insertion over multiple nonparallel attachments, and permitting the denture to respond favorably to masticatory forces dissipating stresses from the abutments. The OT equator attachment's unique design and low profile also compensated for the lack of parallelism and provided resiliency, permitting stress-free insertion, removal, and function [10]. Thus, it was possible to achieve the equitable stress distribution between the muco-osseous and dentoalveolar segments which is required in such cases via the soft retention and elastic functionality provided by the selected attachments [8].

Conclusion

RPDs still have a good place as a preventive treatment option for partially edentulous patients however, the reduced number and compromised condition of the remaining teeth could limit their application in many instances. In such cases, the appropriate incorporation of contemporary attachments should be considered, this can open up a new horizon in preventive treatment planning and patient satisfaction.

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Declaration of patient consent: We certify that we have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity. This work was approved by the ethics committee of the faculty of dentistry, at Ain Shams University, Before an individual subject's participation, (approval number: FDASU-Rec IR 032307; approval date 27/3/2023).

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