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A NOVEL ATTACHMENT SYSTEM TO RESTORE KENNEDY'S CLASS I CASE: A CASE REPORT

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ABSTRACT

Removable Partial Dentures have been used as an economical replacement option. However, the retention of cast partials is extremely crucial for the success of the prosthesis. This case report aims at clinically evaluating the retention and outcome of a new attachment system. RPS is a new attachment system which is designed digitally and provided as an economical treatment option. This attachment system is designed with the principle of reducing the vertical load on the abutment and circumferential retention of the retentive component. The Case report demonstrates the use of RPS attachment system for the mandibular Cast Partial Denture. This system needs further clinical evidence and trials for the maxillary arch.

Keywords: prosthesis, mandibular Cast Partial Denture, Removable partial dentures (RPDs)

INTRODUCTION

Removable partial dentures (RPDs) is an conservative and economical option for replacing missing teeth in partially edentulous patients **[1]**.

Computer Aided Designing- Computer Aided Milling (CAD-CAM) has opened up better solutions for cast partial denture designs and treatments **[2-4]**. This digital workflow is split into 2 ways, direct and indirect method. The direct method is where the operator designs a framework and directly mills or 3D prints in metal by direct metal laser sintering. In the indirect method, the design is 3D printed in wax or castable resin and casted in the conventional way **[5, 6]**.

Once digitally designed, different pathways exist for the fabrication of the RPD framework. The typical digital workflow includes obtaining a digital model of the oral hard and soft tissues. This can be accomplished directly from an intraoral digital scan or from a laboratory digital scan of a stone cast. Second, the path of insertion is defined, and undercuts are color coded based on the depth. Subsequently, the virtual block-outs are automatically calculated and displayed on the virtual cast. The retention grid and major connector are designed, followed by the rests and clasps. After the design is completed, the software will digitally export the designed RPD framework in the form of a stereolithography (SLA) file. The SLA file can be used for the additive or subtractive manufacturing of the RPD framework **[7]**. Depending on the manufacturing process, a definitive prosthesis can be made directly from the digital design or from an intermediate product in the form of a resin-elimination pattern which will subsequently be invested and cast. These new digital workflows may be beneficial compared with the traditional process of waxing and investing, where wax pattern distortion and refractory cast distortion may lead to poorly fitting castings.

CASE REPORT

Diagnosis:

A 45 year old female patient reported to the department of Prosthodontics, Saveetha Dental College, with a chief complaint of missing and carious teeth in both upper and lower, front and back tooth region. Intraoral examination revealed the patient had caries in relation to 17, 14, 12, 22, attrition in relation to 35, 34, 33, 43, 44, 45. 3 Periodontally compromised teeth, supra-erupted 17 and periodontitis in relation to 32 and 42, also seen. The upper arch was classified as Kennedy's Class 3 maxillary

arch and lower as Kennedy's Class 1 Div 1 mandibular arch. Preoperative intra-oral and extraoral photographs **(Figure 1, 4)** were taken as a diagnostic record. After diagnostic impressions and a facebow transfer, the patient was advised a Cone Beam Computed Tomography (CBCT) to check the width and height of bone available in the edentulous spaces. The diagnostic models were mounted on a semi-adjustable articulator by transferring the facebow records and a diagnostic wax up was made for the treatment plan.

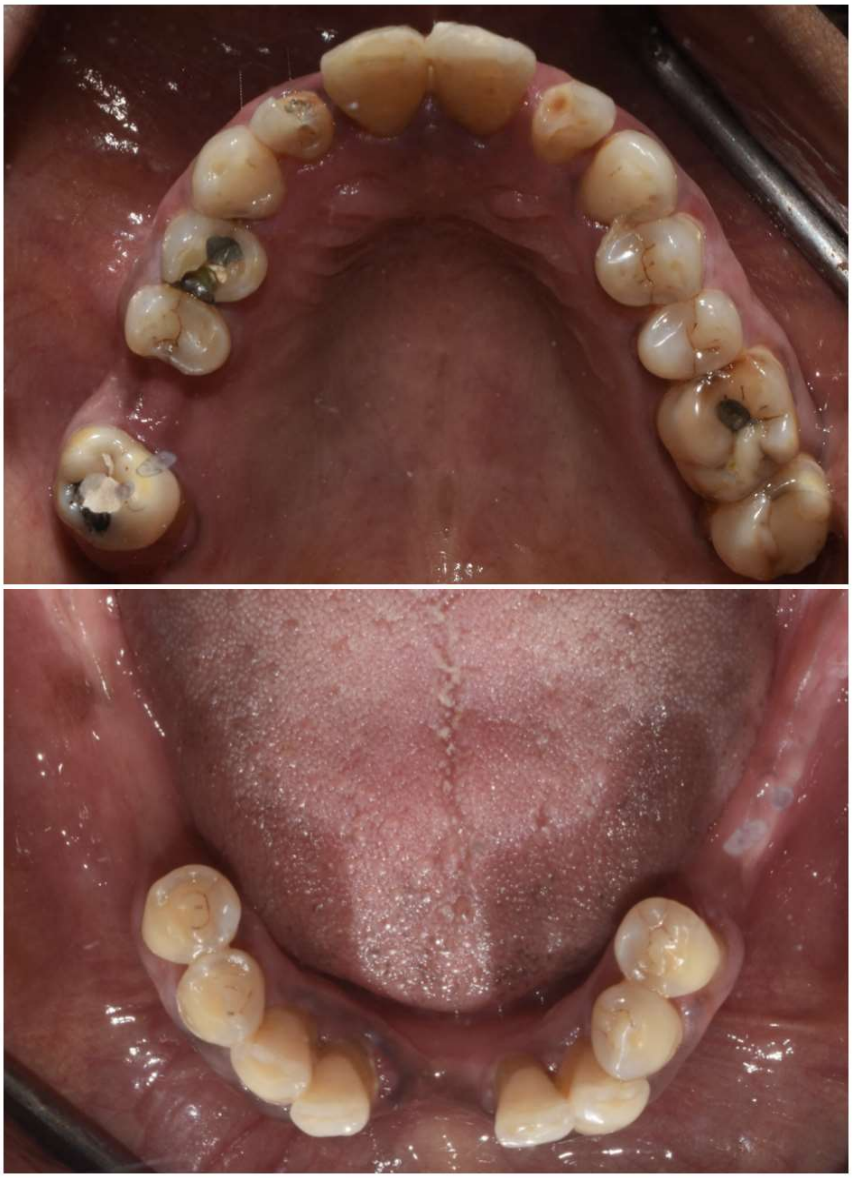

Fig 1: Pre-operative Intra-oral Diagnostic Images

Treatment Plan

As part of the treatment plan, the supra-erupted 17 and periodontally compromised 32 and 42 were extracted. All the carious teeth were restored with bulk fill composites and not root canal treatments were required as there was no pulpal involvement. Although there was sufficient bone for implant placement in relation to 36, 37, 46, 47, the patient was not willing for a surgical procedure. Hence a composite Tooth-Tissue supported prosthesis was planned for the lower arch and only Tooth supported for upper arch. In the upper arch, only 12, 11 from the first quadrant and all the teeth from the second quadrant were involved. The remaining teeth were not involved as there was no sign of attrition or supra-eruption seen.

Treatment:

The teeth were prepared under local anesthesia. Pankey-Mann-Schuyler philosophy (PMS), which states the teeth of one side of quadrants should be prepared and temporized followed by the opposite quadrants to establish the vertical dimension for the final restoration, was applied during the procedure **[8]**. The prepared teeth were temporized and the patient was left to be with provisionals for a brief period of 3 weeks. After 3 weeks,

the prepared teeth are refined and master impressions taken. Two cord retraction, with 0 and 00, were done for gingival retraction before impressions. A rubber base, putty wash, 2 stage impression was done for both the arches. A second facebow record was made to transfer patient records to the articulator. A jaw relation was done with pattern resin as bite registration material (GC pattern resin) with the patients provisional teeth.

The mounted master casts were scanned on a lab scanner (E500 Medit) and the final prosthesis was designed in 3Shape Dental Designer software.

For the upper arch monolithic crowns were designed, single crowns for 12, 11, 22, 21 and a splinted bridge from 23-25 and a distal molar cantilever with a narrow occlusal table. For the lower arch a splinted bridge from 35-45 was designed with an attachment on the distal aspect.

RPS system

This system is a new adaptation for the direct retainers that rest on surveyed crowns and bridges. The splinted anterior bridge is given a modification on the distal aspect, a slide attachment. Adjacent to this slide attachment a rest seat is given on the connector region of the bridge which is parallel to the attachment. This assembly helps in stabilizing the cast partial denture from lever forces which lifts the denture during occlusion. It is designed digitally in a dental designing software (3Shape) where the attachment and the rest seat are added into the bridge with precision and utmost parallelism, bilaterally **(Figure 2)**. The digital workflow creates an even and single path of insertion for the cast partial denture and also spares time as there won't be a need for manual surveying. Since the bridge framework has a male and a female component, the counter parts go into the cast partial framework. This assembly of the components increases the retention of the removable prosthesis. As the RPS assembly is placed distal to the fixed prosthesis, there won't be any clasp assembly that comes to the esthetic zone of patient making that is more acceptable than the RPI assembly.

The copings for crowns and bridges were digitally designed and 3d printed in resin (FormLabs 2) in SLA method and cast in metal. These copings are tried intraorally and thoroughly checked for marginal discrepancies clinically and radiographically. After the trial these metal copings are layered with ceramic and a pickup impression is taken in the patient's mouth which helps to stabilize the framework in the final position before the designing of the cast partial denture. The new cast along with the prosthesis is scanned

again in an extraoral scanner to design the cast partial denture.

Once the cast partial framework is designed, the STL file is sent to a DMLS (direct metal laser sintering) EOS M100 machine for the fabrication of prosthesis. Framework trial is done, along with a final jaw relation to achieve centric relation. The framework is acrylized after a teeth setting trial **(Figure 3, 4)**.

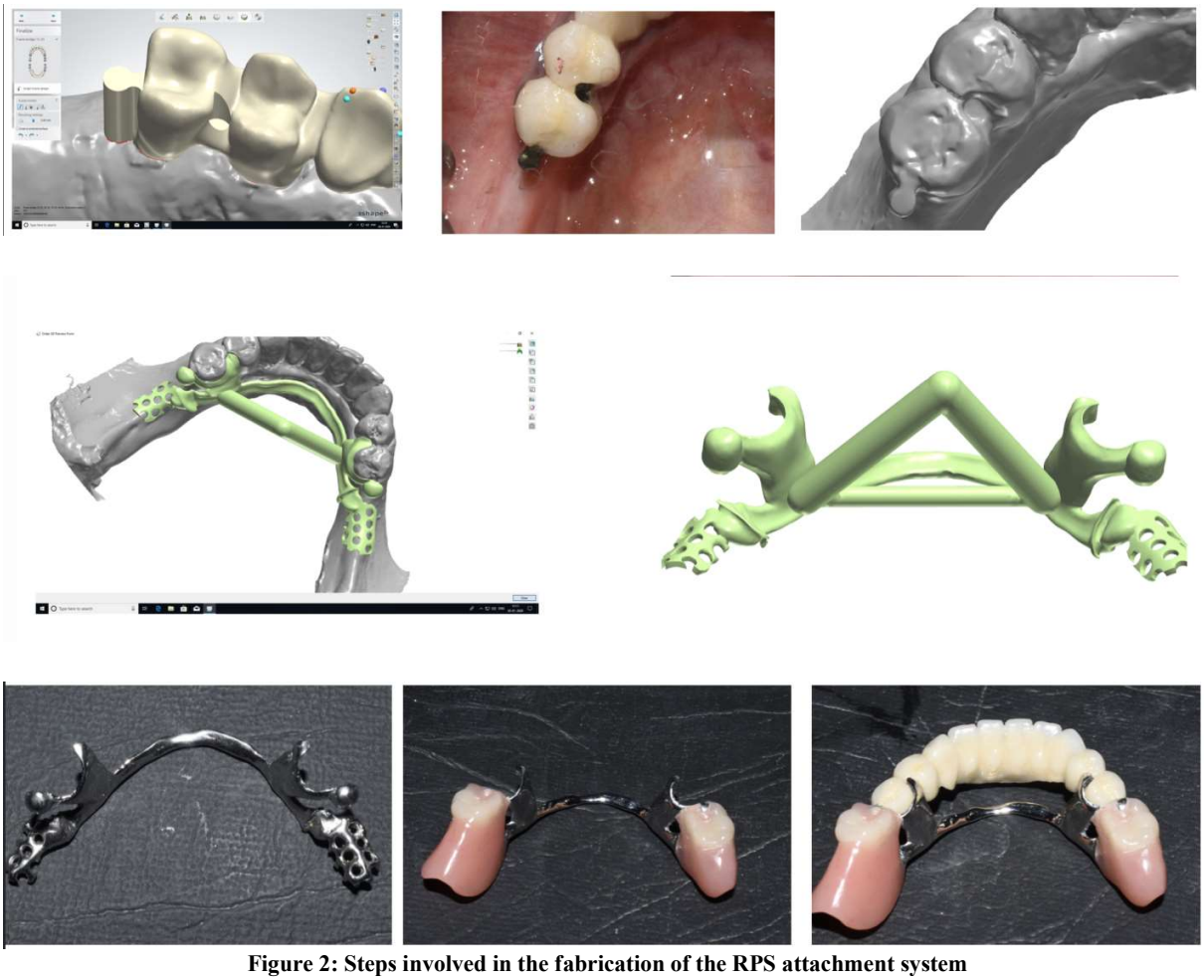

Figure 2: Steps involved in the fabrication of the RPS attachment system

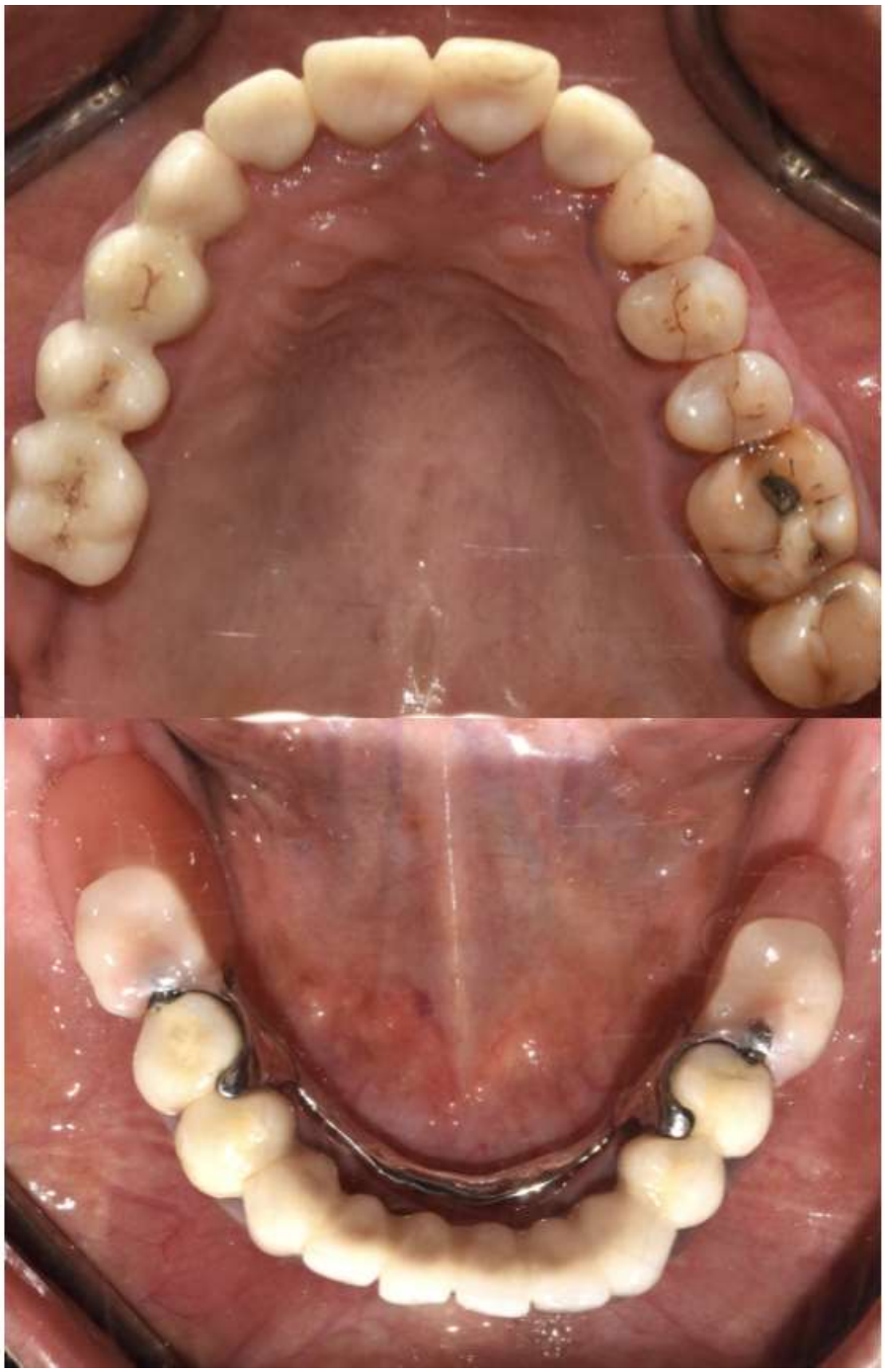

Figure 3: Post-operative Intra-oral Images

Figure 4: Pre and Post Operative Extraoral Photographs

DISCUSSION

In these times of growing popularity of dental implants, the use of removable prosthetics has definitely diminished. However, there are certain critical times when these removable options prove to be very cost-effective and are sometimes the only solution for replacement **[9-11]**.

The case described in the case report, it is a Kennedy`s Class 1 mod 1 mandibular arch with a deficient ridge dimension. In such cases, dental implants are only possible following extensive successful bone augmentation. But unfortunately, it is always associated with an additional cost. In the bargain between cost and longevity, removable prosthetics proves to be the middle ground.

There have been various popular options in removable prosthetics to replace missing teeth in regions of deficient ridges, such as Andrews bar system **[12-14]** or Custom attachments **[15-17]**. Precision attachment-retained RPD are proven to be better than the clasp-retained RPD with respect to esthetics, chewing, and oral health-related quality of life, however, the precision attachment comes along with a different set of problems **[18]**.

However, the use of precision attachment RPD design should be carefully considered, and clasp-type RPDs should be used whenever practical because of their lower cost, ease of fabrication and maintenance, and the predictability of results **[18, 19]**. Repeated removal and placement of prosthesis result in wear of the retention clip, requiring periodic replacement of the clip **[18-20]**. Daily oral hygiene maintenance and care of the prosthesis are required on the part of the patient. The long-term success of the prosthesis requires knowledge of important laboratory techniques, clinical skills, and proper execution of all the clinical and laboratory procedures.

However, most of the popular attachments associated with removable partial dentures, provide retention by means of passive undercuts engaged with an elastic cap or sleeve **[19]**. However, it exerts a detrimental removal force on the prosthesis **[21]**. Repeated removal and placement of the prosthesis can lead to wear of the elastic cap or sleeve. This creates the need of regular maintenance of these attachments. RPS attachment system is a solution with provides retention using frictional force **[22, 23]**. It works on similar principles as to a telescopic denture, however the fabrication is not as technique sensitive as a telescopic coping **[24, 25]**.

In the following case, the RPS attachment was used as the retentive component of the mandibular partial denture. The case was followed up for a duration of 1 year. The patient was extremely comfortable. The patient added that the RPS attachment system was very helpful in guiding the patient in the placement of the cast partial denture.

CONCLUSION

This article describes rationale and technique for fabricating RPS attachment for rehabilitation of edentulous mandibular arch along with the various advantages and disadvantages of the same.

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