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Thermoplastic Partial Overdenture as Esthetic Alternative for Labial Undercut and limited Inter-arch Space with One-year Follow-up: Clinical Report

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Few remaining healthy teeth in a patient who is concerned about appearance is very challenging for the prosthodontist, especially if the patient can't afford for implant supported prosthesis and the fixed replacement couldn't be an option for managing such case. Partial overdenture arises to be the saver in these cases where dome shape reduction reduces the mobility of the tooth by improving the crown root ratio and doesn't require the biological width needed for the preparation of the fixed restoration. Thus preserve the tooth and the surrounding alveolar bone and provide support to the removable prosthesis. The management of occlusal problems due to long period being partially edentulous without restoring the missing teeth requires first an analysis phase to the existing occlusion, and a prosthetic wax up of the proposed prosthesis on the mounted diagnostic casts to guide the treatment plan properly and all the steps of rehabilitation. Taking into consideration the functional and esthetic outcomes to achieve patient's satisfaction. The case presented highlights the importance of detailed clinical and radiographic examination in addition to analysis of the available prosthetic spaces on mounted diagnostic casts aiming to the success of managing it. Besides, showed the effectiveness of using thermoplastic partial overdenture for patients with labial undercuts and limited inter-arch space. After one-year follow-up, the patient was satisfied with the esthetics and easy of use of the thermoplastic as well as the metallic prostheses.

Keywords : Flexible denture, Valplast, esthetic alternative, overdenture, crown lengthening

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Introduction

Preventive prosthodontics denotes the procedures that can make deferral or lessen future prosthodontic problems. It decreases the severity of the problem, which adversely affects the orodento-facial tissues. Overdenture is one of the treatment options in preventive prosthodontics.[1]

Overdenture is indicated in patients with few remaining healthy teeth in an arch. It can provide the best solution for patients with roughly diminutive or hopeless dentition diagnosed for entire extraction, because overdenture is concerned in persistent alveolar bone preservation of the supporting teeth/ root components or implants. In addition, it maintains the periodontal sensory receptors which indexes and detects gnathodynamic tasks that will enhance gnathodynamic functions and psychology of individual's by maintaining the proprioceptive impulses.[2,3] Prosthetic rehabilitation should be capable of regaining the lost function and esthetics. Though, conventional removable partial dentures (RPDs) are constructed from a metal framework that contains clasps on the abutments to gain retention. The clasps used on anterior abutments are usually visible when the patient smiles. These visible components may cause dissatisfaction with the esthetic appearance that lead patients to reject this treatment option.[4]

Some clinical situations complicate the treatment procedures, like the presence of undercuts either soft or bony tissues.[5,6] Though may lead to difficulty in the placement of dentures, beside the presence of bulbous labial cortical plate with severe undercut can affect the appearance of the denture.[7]

The patient's demands were continuously aimed by making improvements in the quality of materials used for constructing dentures and applying them in different clinical cases.[8] A flexible denture is a RPD constructed from thermoplastic resins without using metal. Currently the available flexible materials used are Polyamide resins (nylons), Polycarbonate resins (polyesters) and Polyethylene terephthalate resins. It offers several advantages as esthetic that matches with the underlying mucosa thus can be used in cases complaining of the metallic appearance of anterior clasps, their flexibility allow the incorporation of the denture flanges into the undercut area without causing any irritation and for management of cases with limited mouth opening. It has less complicated design and no need for mouth preparation as compared to cast RPD. In addition, the flexible denture is light in weight and this makes more comfort to the patient when wearing the denture. Flexible denture is also flexible in nature, it may act as stress breaker and transmits less amount of forces to the abutment teeth.[9,10]

On the other hand, nylon denture has a far lower flexural modulus than PMMA materials, although having physical and mechanical qualities that are comparable.[11,12] Additional drawbacks include the fact that acrylic teeth are mechanically attached to nylon denture base, increasing the possibility of their dislodgement. Fitting a flexible denture requires additional expertise and tools and the denture material becomes tougher with time. Besides flexible prosthesis is difficult to reline, rebase or repair.[9,13]

Patients with significant overbite, posterior inter-arch spacing of less than 4 mm, bilateral distal extensions with knife-edge ridges or lingual tori, or displaceable flappy tissues as a result of decreased tissue support should not wear flexible dentures.[9] RPDs made from acetate and polyamide resins have a high prospective to rehabilitate partially edentulous patients and their favorable properties let them to be applied without concerns when well indicated.[14]

Human teeth undergo incessant axial eruption once they aren't opposed by the antagonistic teeth anymore.[15] This process decreases the available prosthetic space thus compromises the design of the prosthesis needed to restore the partial edentulism and impedes its functional

integration. [16] Regaining the limited interocclusal space is mandatory for a successful prosthetic treatment. [17]

Interarch distance dimension must be accurately measured on the mounted casts for planning the case. [18] The extension of interocclusal space has been approached from various method; enameloplasty if slight amount required, restoration with a shortened prosthesis, orthodontic intrusion of the over-erupted teeth, maxillary alveoloplasty, or reduction of the over-erupted teeth (which may require periodontal surgery and endodontic treatment). [19] Surgical crown lengthening procedure is preformed to give a retention form that assists in accurate tooth preparation, making impressions, locating restoration margins, and achieve the esthetics required. [20]

In this case report, the most suitable options to have successful and comfortable solution to the patient were selected. Upon which the proper treatment plan was formulated and the procedures were carefully done for about six month then after finishing, there was follow-up visits for one year after that.

Materials and Methods

A 42-years-old female patient who presented to the out clinic of Taibah University Dental hospital with chief complaint; "I want to fix my frontal teeth because I don't like the appearance". The patient mentioned that she is non-smoker and hasn't any systemic disease and didn't take any medications, but has family history that her parents had diabetes mellitus and hypertension. Thus she was suspected of medical factor for the early loss of her teeth and upon laboratory investigation of Hba1C, she was revealed to be type II diabetes (Hba1C= 7.1% diabetic well controlled). [21]

After a thorough clinical and radiographic examination, two main challenges were identified in this case: First, in the upper arch, the presence of a labial undercut, the patient's aesthetic concerns with multiple missing teeth, and posterior limited inter-arch space on the left side due to over eruption of #34, 35 and on the right side over eruption of #17. Second, in the lower arch, a radiolucency related to remaining root #41 was noted. Fig. (1, 2) A treatment plan was formulated to manage the patient and was discussed with her and she signed an informed patient consent. The case report was approved by the ethics committee of Taibah University. (TUCDREC/301023)

Fig.1: Pretreatment intraoral photographs (A. Lateral (L & R) and B. Occlusal (U & L) views)

Fig.2: Panoramic radiograph showing the remaining teeth and the anterior periapical lesion related to #41

Upper and lower primary impressions were taken using Alginate in stock trays, then upper and lower occlusion blocks were constructed on the primary casts where preliminary jaw relation was registered at her centric relation, in addition facebaw record was taken. Then the existing occlusion was analyzed on the mounted casts on semi-adjustable articulator, and the required adjustments were identified where on the left side opposing to the over erupted #34 and #35, the available space was just 5mm and 3.7 mm respectively. While on the

right side extraction of the mesially tilted #47 and dome shape reduction to the over erupted #37 Fig.(3) These planned modifications were revealed in the wax-up and the teeth arrangement, and this prospective model was used to estimating the form of the future prosthesis, assist the patient's understanding and utilized in the fabrication of provisional prostheses. Then surveying of the mandibular cast and the design of lower metallic RPD was executed. At first, surgical extraction of #41 remaining root with enucleation and curettage of the cyst and was sent for microscopic examination, that revealed a periapical cyst Fig. (4). Then extraction of extensively decayed tooth # 47 was preformed.

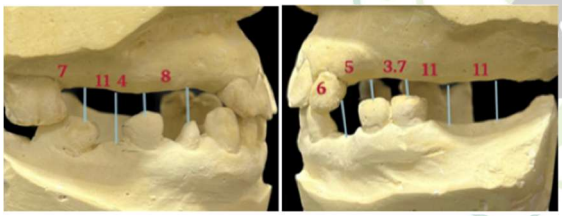

Fig.3: Occlusal analysis of the mounted casts to evaluate the available inter-arch space.

Fig. 4: Surgical extraction of #41 remaining root with enucleation and curettage of the cyst and microscopic picture of the lesion.

Subsequently, oral hygiene measures and periodontal treatments were performed where periodontal charting (mobility, recession, probing depth and Cal) to the existing teeth was recorded. She was diagnosed as generalized moderate periodontitis with localized severe periodontitis related to #17 according to American Academy of periodontology (AAP). Supra and sub gingival scaling for all remaining teeth and root planning were done and reevaluation after 4-6 weeks was performed where plaque and bleeding on probing index percentage markedly decreased (55.9% to 9% and 78.5% to 12% respectively).

Upon caries risk assessment, she is at high risk. Most of the existing teeth were either carious or has defective restoration. Thus caries excavation, cavity preparation and restoration to these teeth were performed. Evaluation of the periapical radiograph of the previously endodontically treated #12, 21, 22 and 44; where they were found successful and endodontic treatment was performed for the teeth #17, 11, 22, 34 and 35.

The defective porcelain fused metal (PFM) crown restoration on #22 was removed because of the open margin. A temporary crown was made but fall done where the remaining tooth structure is non retentive thus was taken as overdenture abutment rather than fixed restoration on it. For #44 the existing crown preparation was refined and temporary crown was constructed on it.

Planned surgical crown lengthening was performed on teeth #34 and 35 to provide proper clinical crown height for the surveyed crowns to restore appropriate periodontal-prosthetic relationships that respect the durability of the biological space.

Dome shaped preparation was performed for teeth #12, 22 and 17 as overdenture abutments for the maxillary partial overdenture. Afterwards, upper and lower interim RPDs were constructed to correct the predetermined occlusal height in centric relation. Post cementation and the crown preparations for #34, 35 were done guided by the corrected occlusal plan of upper acrylic RPD and their wax pattern were surveyed and constructed in accordance with the proposed RPD design.

For the upper arch, E-max crowns were constructed for #11 and 21 while for the lower arch, PFM crown on #44 and surveyed crowns on #34, 35 were constructed and cemented followed by the steps for the final removable prostheses Fig.(5). Maxillary partial overdenture where thermoplastic material (Valplast) was

selected and mandibular cobalt chromium alloy RPD construction were done. Metallic RPD designed with notched lingual plate mandibular connector to accommodate the spacing found between #42 and 43.

Fig. 5: A. Full ceramic crowns cemented on # 11, 21 and Prepared dome shaped partial overdenture abutments #12, 22. B. Surveyed crowns cemented on #34, 35

In the insertion visit, it was observed that the maxillary flexible overdenture didn't engage properly the labial undercut by its flanges where the two central incisors obstruct its insertion, thus a vertical split was introduced in the midline for ease of insertion and not to affect the retention of the prosthesis Fig.(6). The patient was given the instructions for proper denture hygiene and the appointments of the follow-up.

Follow-up visits after 6 month and one year were done to inspect the dentures and evaluate the patient's satisfaction with them. Besides periapical radiograph was taken to evaluate the healing related to #41 extraction socket.

Fig. 6: Pre and post treatment frontal view.

Discussion

Loss of teeth without replacement with proper prosthesis for long time leads to an occlusal disorder that produces functional and esthetic impairment. These disturbances comprise egression of opposing teeth and subsequent diminution of the available prosthetic space. Management of such complications necessitates thorough analysis to the existing occlusion that can be approached by materializing the prosthetic project thus can visualize the final rehabilitation results in advance and can discuss them with the patient. Fixed prosthesis is frequently chosen as therapeutic option to reestablish the disturbed occlusal plane where tooth preparation is done guided by the prospective prosthetic wax model to create the required space for the future opposing prosthesis. [16] The thought behind further loosing the remaining teeth is very upsetting to the patient. One of the most applied managements used in preventive dentistry is overdenture, where it reduces residual ridge resorption and decreases alveolar bone compression. In addition proprioceptive property is preserved. [2,3]

In the present case an analysis phase to the existing occlusion and a prosthetic wax up on the mounted diagnostic casts was prepared to guide the treatment plan properly and all the steps of rehabilitation. Taking into consideration the functional and esthetic outcomes to achieve patient's satisfaction

In challenging cases, presence of tilted or over-erupted teeth and deranged occlusion, bony undercuts can complicate its management and need precise procedures. Flexible dentures can be a good treatment option to achieve the clinical need for rehabilitation of such conditions. In the past, flexible dentures were hardly chosen by patients and clinician but nowadays it has become an elective treatment option. [22]

Rehabilitation of partially edentulous patients was done for decades using chrome cobalt alloy RPD and it was held in position by cast clasps. This is satisfactory when used on posterior teeth rather than on the anterior teeth for its metallic display. The metallic appearance of the clasps is restrictive especially on maxillary canines when restoring missing posterior teeth, this is not preferred by many patients, mainly who are concerned about their esthetics. [6] Thus for this patient metallic RPD was used to restore the missing lower teeth while flexible partial overdenture was used to restore missing upper teeth. In addition to its

esthetic advantage, thermoplastic resin material can be used as alternative to conventional acrylic resin material as a denture base in overdentures where it was shown to have higher fracture resistance. [23] and in another study it was shown that thermoplastic overdentures had more favorable bone/implant interface and can provide well fitted denture base compared to poly methyl methacrylate denture base processed by conventional method.[24]

Detailed clinical examination accompanied by radiographic examination and careful occlusal analysis of mounted diagnostic casts influenced greatly the treatment plan procedures and ensures the success of the prosthetic management. The radiographic examination revealed the cyst related to the remaining root that was asymptomatic and showed the periodontal status of the remaining teeth and the availability to be used as abutments for the overdenture further more the periodontal and bony status for crown elongation for the surveyed crowns. Besides radiographic evaluation was used to evaluate the status of the previous endodontic treatments and determine its success and no need for retreatment and can make crown restoration to protect these teeth.

Acrylic interim RPD can be used temporary to restore the proper occlusion planned upon the analysis of the existing occlusion till patient accommodation is established. In addition, it can act as guidance during crown preparation of the over-erupted opposing teeth thus the surveyed crowns would be constructed to the appropriate occlusal plane and centric relation.

Flexible partial or complete dentures are contraindicated to be used in cases with insufficient inter-arch space that is less than 4 mm space, because over-erupted teeth allow less space for positioning opposing artificial teeth. [22] Acrylic resin teeth don't bond chemically with flexible denture base resin thus T–shape holes are necessary for mechanical retention of these teeth into which the resin flows. [25] It is very essential not to be removed in adjusting the teeth height to be positioned in the available inter-arch space.

As part of the prosthetic space management, different interventions can be followed according to the amount required to be restored. The prosthodontist should take the right approach to manage these cases of occlusal disturbances depending on proper analysis of the existing occlusion on the articulator to measure the available prosthetic space. In this presented case, the construction of fixed prostheses on the opposing # 34 and 35 were planned to adjust the improper occlusal plane and restore the prosthetic space suitable for the maxillary prosthesis and that encounters functional requirement. Mami et al.[16] to manage their case also followed this procedure. But this required performing crown lengthening first in order to improve the clinical crown length of the teeth.

One of the advantages of flexible partial denture that it can be retained by entering into undercuts by an extension extended into them which act like clasps. In the insertion visit when there was difficulty encountered to insert the upper flexible partial overdenture as the two abutments prevented the continuous anterior flange to enter to the labial undercut. A vertical split was made in the mid line instead of removing the flange related to the remaining two centrals thus the resin was extending onto the adjacent abutments (clasp-like extension) that provided direct retention to the prosthesis.[26] In addition the labial flange had an esthetic effect as it covered the physiologic pigmentation existing in the anterior region and that pleased the patient especially while smiling as they show through her high lip line.

Flexible dentures aren't intended for as long term prosthesis and are used only for temporary or provisional applications while metallic partial dentures are still the standard for long-term restoration.

Flexible prosthesis is difficult to reline, rebase or repair and it is liable to be stained from food or drinks if it isn't

properly polished and/or cleaned by the patient on a regular basis. [13, 22] So as to maintain the esthetics and cleanliness of the prosthesis, the patient was advised to keep the good oral hygiene practices and clean her prosthesis regularly after every meal and to remove it during brushing of natural teeth to avoid its scratching. [6, 22] In addition not to use any chemical cleansers where their use may damage the thermoplastic denture base and corrode the RPD metal framework. [27]

In the follow-up visits, the patient after one year of using her prostheses was still satisfied with the esthetics and retention of both prostheses, this incidence is in accordance with other case reports that concluded that flexible partial dentures are suitable choice for the replacement of missing teeth mainly in cases concerned about esthetics and can sufficiently meet the expectations of patients not accepting the treatment with conventional rehabilitation. [8,13, 14, 22, 28] In addition to the randomized clinical trial that indicated that the superiority of thermoplastic resin RPDs over conventional metal clasp-retained RPDs with respect to patient satisfaction reported in a previous study. [29,30]

The patient was satisfied with the retention of the maxillary flexible partial overdenture after 1 year of use that in accordance with the study that showed that thermoplastic partial palatal coverage dentures showed retention compared to that in complete palatal coverage verifying that the missing peripheral seal in any part of the flexible denture not negatively affects its retention even after six month of use. [31]

The patient was very satisfied with the flexible partial overdenture and handled the denture well and presented satisfactory function and the tissues adjacent to it were in excellent condition. This with accordance with Samet et al's [32] case report who had oral and manual dexterity limitations and was rehabilitated with flexible RPD that used it for 3 years and Vacek 's [33] patients who used polyamide RPDs for six months. The maintenance of healthy remaining teeth (#17, 12, 22) as abutments for partial overdenture offered effective prosthetic treatment, where preserved the proprioceptive response of the teeth and decreased the alveolar bone resorption. [2,3,34,35] Further more the dome shape and reduction of the overdenture abutments approximately 3 mm above the free gingival margin provided contact mark between the denture base and the abutments that provided additional support to the denture and decreased its tissue ward movement which minimizes harmful horizontal pressure influence (gum stripper effect). [36]

Outcome (Clinical Relevance)

Careful clinical and radiographic examination is very essential to elaborate the oral conditions beside the investigations when needed. Where the patient was undiscovered diabetic type II and a radiolucency related to #41 was found. Proper analysis of the mounted casts led to proper occlusal plane that was reached with interim RPD and crowns after performing the needed crown lengthening. Finally the thermoplastic RPD was constructed after preparing the overdenture abutments #17, 11 and 21. After one-year follow-up the patient was satisfied with the outcomes.

Conclusion

The case presented highlights the importance of detailed clinical and radiographic examination in addition to analysis of the available prosthetic spaces on articulator in the success of managing it. Besides, showed the effectiveness of using thermoplastic RPD for patients with labial undercuts and limited inter arch space. After one-year follow-up, the patient was satisfied with the esthetic and easy of use of the Thermoplastic as well as the metallic RPDs.

Funding of the Study

This study is self-funded. It did not receive any financial support.

Ethics Approval

This case report was approved by College of Dentistry, Taibah University, Ethics committee
(Number of approval: TUCDREC/301023) and the patient signed the consent form for her acceptance.

Availability of Data

All data about this case are available from the corresponding author upon request.

Competing interest

The authors declare that they have no financial interests or personal relationships that could have shown to influence the case reported in this paper. There is no conflict of interest.

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