

Original Article

Evaluation of Different Treatment Modalities for Rehabilitation of Mandibular Atrophy

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ABSTRACT

Long term edentulism may lead to residual alveolar bone resorption and consequently flat ridge. A flat ridge is associated with difficulties in providing successful prosthesis. Lack of adequate support, retention and denture stability are the most common problems. Successful restoration can be done with various conventional and contemporary treatment options. As each patient has his own specific clinical situation, treatment plans will be changed accordingly. In this study, three different treatment modalities were used to rehabilitate mandibular flat ridges, namely: implant supported overdenture, precision attachment supported partial dentures and a combination of precision attachment with implant supported bilateral distal extension removable partial denture. The three modalities were successful in terms of retention, function, esthetic and patient satisfaction.

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INTRODUCTION

As the older population grows quickly, dentists will see extra advanced, complicated cases with serious health problems more often. Dental professionals are obligated to grant them the most effective result that is more comfortable and esthetically acceptable in relation to the patient's considerations, each physically and psychologically. To improve the oral conditions, traditional dentures are still considered to

be the most economic treatment, but these dentures could not satisfy patient's expectations as they may cause more damage to oral structures [1].

Lack of reliable support from tooth and soft tissue and residual alveolar bone resorption are some of our challenges, as they lead to displacement of bilateral and unilateral distal extension removable partial dentures and complete removable dentures as well [2].

All dentures' designs (especially distal extension removable partial denture) are subjected to different types of forces, such as vertical, horizontal and torsional forces, that may have adverse effects during functional and parafunctional activities [3].

To compensate those forces many variations in denture design (denture base, framework, retentive means) have been adopted, those variations may have an effect on retention, stability and support of the denture [4].

Therefore, precision attachments, conventional clasps have been widely used to increase denture stability. In addition, implant placement in the posterior area of distal extension removable partial denture was a successful solution to denture instability problems, and had increased retention of removal prosthesis considerably [5].

Several attachment systems have been used to increase implant supported overdenture retention and they are compatible with most implant systems. These attachments include studs, bars, magnets and telescopic crown attachment [6]. The O-ring is possibly the most popular stud system used among dentists to improve retention of partial and complete implant supported overdentures. O-rings are elastomeric retentive attachments, usually made of silicone, and have many advantages such as ease of use, reliability of retention, simplicity in design uncomplicated maintenance, and low cost [7]. In spite of the increased use of Implant-supported prosthesis, sometimes they are not feasible either due to insufficient amount of bone or financial reason, therefore precision attachments were the solution for many of those cases. Retainers and precision attachment components of partial dentures facilitate both esthetic and functional replacement of missing teeth [8].

Rehabilitation of partially edentulous arch can be challenging for clinicians in terms of denture design

and maintenance when it is distal extension situation classified as Kennedy class I and class II. Whether or not in combination with oral implants, precision attachments often offer patients improved self-confidence and self-image. [2,8].

Therefore, dentists must be open to alternative treatment possibilities to face challenges and to meet the patient's expectations beyond those offered by traditional ideas.

In this study, we aimed to use 3 different treatment plans for replacing missing teeth (partially and fully edentulous patients) to achieve the best result that is more comfortable, esthetically acceptable, functional and financially afforded with such advanced cases.

The treatment options were: implant supported overdenture, precision attachment supported distal extension partial denture and the third option was a combination of the first two solutions. It was precision attachment combined with implant-supported bilateral distal extension removable partial denture. The first patient was female patient, 68 years old reported to Magdale dental clinic (Tripoli / Libya) complaining of loose lower removable complete denture and inability to chew food. Her medical history did not reveal any systemic disease. On examination, we found that she was completely edentulous and has a flat ridge and no means of retention available due to loss of supporting bone. The first treatment option (implant supported overdenture) was selected for her. The second patient was a male patient 72 years old visited Magdale dental clinic complaining of loose and uncomfortable lower partial denture and inability to chew food or speak while wearing the denture. On examination, he was wearing an ill-fitting distal extension chrome-cobalt partial denture and only teeth number 43, 33 and 34 had sound periodontal support and good clinical crowns. The patient's medical history disclosed no major systemic problems except that he is following an Aspirin treatment. Precision attachment supported

partial denture with distal extension (the second treatment option) was the plan followed for him. The lower canines were too strong so they can provide good support to the lower partial denture and the bridge as well. The last case was the most complicated patient, A female patient 70 years old partially edentulous was referred to Magdale dental clinic, complaining of difficulty of food chewing and poor retention and esthetics of the existing denture. The patient's medical history revealed that she had a cardiac catheterization five years ago and she is on anti-coagulants (an Aspirin treatment), and she was suffering from unexplained anemia. Hence, due to her poor medical condition, the least invasive treatment plan has to be followed. After a thorough dental examination, only teeth number 31, 32, 41, and 42 were present, with strong periodontal support, firm attachment and no signs of mobility at all. For that reason, we strongly recommended keeping the lower incisors to use them in our treatment plan. However, the use of lower incisors alone to support PFM bridge and a chromium cobalt denture at the same time would be unwise decision, as they cannot provide adequate support for both prostheses. Her OPG revealed low density mandibular alveolar ridge. This problem rendered using an implant (alone) to support a removable denture is a risky choice, as implant failure or dislodgment may occur. Consequently, the solution for this complicated case was combining precision attachment and implants to support bilateral distal extension removable partial denture.

The purpose of this study is to evaluate the effectiveness of three different treatment modalities to rehabilitate mandibular atrophy.

METHODS

Implant placement

The surgical procedure consisted of local anesthesia and crestal incision, followed by elevation of a full-thickness mucoperiosteal flap. After the implant

sockets had been prepared implants (B&B Dental implant; 4.0 mm in diameter, 10mm in length) were placed without complication in the areas of the mandible. The final insertion torque value recorded during placement of the implants was 35 Ncm. The mucosa was sutured after placement of the implants, with the healing abutments exposed.

Four months later, after the healing period and osseointegration occurred the healing abutments were replaced with Titanium + tin (nitride coat) spheroblock

Overdenture modification

The previously fabricated complete dentures were designed to accommodate the subsequent inclusion of 2 metal-housed female parts on the tissue surface of the removable denture base, and yellow coloured O rings were inserted (Rhein 83 OT CAP attachments system, Italy) These O rings will provide retention to the prosthesis.

The existing mandibular removable partial denture for cases of partial edentulism was also lined with soft-reline material after sufficient room had been established between the healing abutments and the interior acrylic surface of the denture, and the patient used the modified RPD during the osseointegration period.

Natural teeth preparation

Tooth preparation of the lower existing natural anterior teeth was performed, and they were used as abutments to receive porcelain fused to metal bridge with precision attachments connected to the crowns of the two most distal abutments. The prepared abutments were temporized after definitive impression making and sending to the lab for casting afterward.

PFM bridge with precision Attachment fabrication

Metal ceramic crowns waxed up with attachment structure were casted and porcelain firing was done. Joint crowns were fabricated with the attachments in the laboratory and the trial of the same was done to check the exact fit of the crowns

Cast partial denture with attachment was fabricated in the laboratory and the metal framework trial was done in the patient's mouth for the accuracy of fit. Cast structure framework was checked up for stability and precision and jaw relation were recorded.

Prosthesis cementation

Complete seating of finished mandibular combined prosthesis with extracoronary castable distal extension precision attachment was evaluated clinically. Metal ceramic bridge with the attachments was cemented, Attachment retainer partial denture is placed the day after to allow the cement in the metal ceramic bridge to set completely.

Combining PFM with precision attachment bridge and implant supported partial denture

PFM with precision attachment bridge alone for the third case was not effective, therefore posterior implants were placed to enhance retention of the prosthesis. All the previously mentioned methods and techniques were applied for this most critical case, in terms of: surgical implant placement (least invasive approach), partial denture modification and utilization at a temporary prosthesis, natural teeth preparation, PFM bridge with precision attachment fabrication and finally combining this precision attachment with the implant o ring attachment system to support bilateral distal extension partial denture.

RESULTS

Implant supported overdenture

This approach provided a perfect retention and stability of the prosthesis with good esthetic result. The implants Osseo integrated perfectly, and the O rings (Rhein 83 OT CAP attachments system, Italy) attachment system provided retention to the prosthesis. The patient was satisfied with the restoration, as she was able to perform routine oral functions easily.



Figure 1.

Precision attachment supported removable partial denture

A stable PFM bridge with Precision attachment was obtained as the lower canines were too strong so they provided good support to the lower the bridge and partial denture as well.

Attachment retainer partial dentures with occlusal rest were fabricated and 2 yellow colored O rings were inserted in the female counterpart, the final prosthesis was firm, with superior patient appearance, satisfaction and restored function as he was able to chew properly, speak easily and maintain good oral hygiene.

Quadruple attachments retainer partial denture was designed with 4 female counterparts with 2 pink and 2 yellow O rings.

PFM bridge was designed to carry 2 male portions of the precision attachments whilst the implants will carry the 2 Titanium + tin (nitride coat) spheroblocks. This design offered stability, retention, better performance and function. The patient was extremely happy with the result, as she finally got a reliable prosthesis with the ability to eat a variety of healthy dietary options, which eventually has improved her overall health and wellbeing.



Figure 2.

Combining precision attachment with implant supported partial denture

The aesthetic and functional results of this approach were very satisfactory, as the removable partial denture gained support by both of fixed bridge anteriorly (on the firm lower incisors) and implants posteriorly.

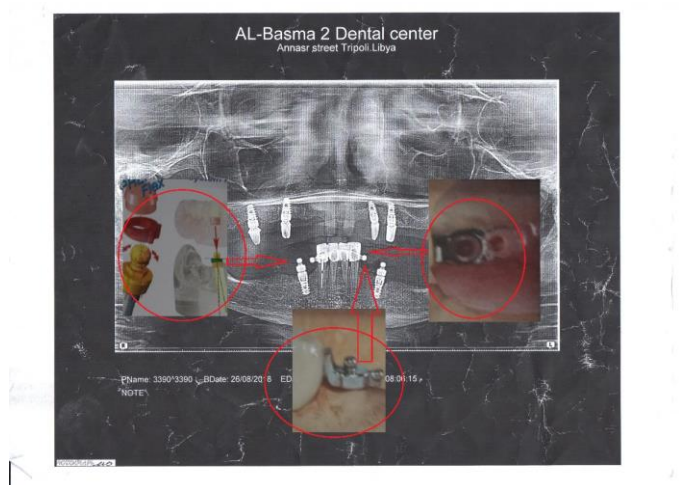
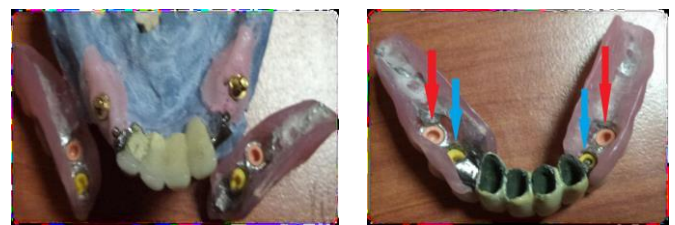


Figure 3.

DISCUSSION

Elder patients with systemic diseases can benefit from oral implant rehabilitation, which will significantly increase the patient's quality of life and sometimes will even improve its medical condition. Given the altered biological constants of the patient, the medical team must be able to offer convenient treatment options for each case.

Before the era of dental implants, complete edentulous jaws were restored with conventional complete dentures, as this was the only option available. Partial dentures had also enjoyed a wide range of use for treating various partially edentulous cases [1]. Many problems had been noted with the use of partial and complete dentures. Poor retention, lack of stability, discomfort during use and unaesthetic appearance are the most common complaints associated with distal extension removable partial denture [5].

Rehabilitation of partially edentulous arch can be challenging when it is a distal extension situation classified under Kennedy's class I and class II situations. A variety of treatment options can be applied according to the clinical situation of each case, such as implant placement in posterior region, acrylic partial denture and cast partial dentures. The latter is made retentive by the use of retainers and precision attachment components to improve removable prosthesis outcome. Attachment-retained cast partial dentures facilitate both esthetic and functional replacement of missing teeth [5,8].

Implant supported overdenture have been shown to be feasible and highly successful treatment option and have good clinical efficiency. Implant-supported overdentures with ball and socket attachments are more successful, provide good retention, stability for the denture and improve comfort and confidence for the edentulous patient while speaking and masticating [9].

Patients treated with tooth-supported distal extension RPD combined with an attachment design can fulfill the requirements of patients' expectations like comfort, esthetics and function and secure durability [10].

In this paper three different cases dealt with by different treatment modalities. As each case has its own clinical situation the treatment plan was applied accordingly. The mutual thing is the attachment system through the application of retentive caps for the three patients, as they were used with overdenture o-ring abutment (o-ring attachment system), with the precision attachment -retained cast partial dentures and finally with an implant-supported bilateral distal extension removable partial dentures with a precision attachment.

The first patient was completely edematous and the mandibular alveolar ridge was resorbed, therefore she complained from looseness in her lower denture. Implant supported overdenture was the treatment of choice, hence 2 implants were placed in the canine regions of the mandible. This has clearly increased the retention of the denture. The patient was greatly satisfied the result and she was able to eat properly. This treatment option was suggested by the McGill consensus statement on overdentures in Canada in 2002, they stated that: There is now overwhelming evidence that a two-implant overdenture should become the first choice of treatment for the edentulous mandible [11]. In 2009 York a further consensus statement was released. The York statement concluded that 'a substantial body of evidence is now available demonstrating that patients' satisfaction and quality of life with implant supported mandibular overdentures is significantly greater than for conventional dentures [12]. Therefore, this treatment modality has been widely applied.

The second patient used several partial dentures previously, but none of them was useful. As his lower canines were present, they were used to support the

fixed bridge on the anterior region. Canines are the most important proprioceptive organs, the shape and strategic position, and the larger periodontal attachment area make them ideal abutments [13]. Therefore, the patient received a metal ceramic prosthesis with precision attachments supported by lower canines. Those attachments are used to increase the retention of the bilateral distal extension removable partial denture. The classic indication for precision attachments is in patients with natural anterior teeth and unilateral or bilateral distal extension cases for whom high esthetic demands must be met [14].

The patient was highly satisfied with the prosthesis in terms of comfort, retention, function and esthetic. Vaidya et al 2015 also used this treatment approach to rehabilitate a patient with the help of a combined prosthesis in the upper arch. They concluded that attachment retained dentures provide long term prosthetic stability along with support to the oral and facial soft tissue, which can improve patient's confidence and alleviate insecurity.

The most interesting and complicated case was the last one, which was a combination of both solutions used for the first two patients. She had many medical issues as she suffered from severe anemia, undergone a cardiac catheterization and she was on anticoagulants treatment. The patients who take anticoagulants require surgical procedures with some measures, which are less invasive, for example the flapless insertion of the dental implant, bleeding is reduced to a minimum and reduced associated risks [15]. Thus, a less invasive treatment has to be applied. Our patient had severely resorbed with low density mandibular alveolar ridge. Therefore, we cannot guarantee that the implants alone will be too strong and osseointegrated properly to provide enough support to the removable denture.

As the lower anterior teeth were present, strong and stable, a fixed bridge with distal precision attachment

was constructed to provide some support for the posterior partial denture. However, the precision attachment was not enough to retain the removable denture, as the anterior teeth are not able to carry a removable denture on their own, because the posterior occlusal forces are too heavy. Consequently, two implants were placed in the premolar region of the mandible bilaterally. This will significantly improve the partial denture retention. As mentioned, early implant supported partial denture has been widely adopted due to their high success rate [13]. One could ask, why did not we extract the lower incisors and replaced them by 4 implants and made an implant supported denture? The answer is, these incisors are still firm and strong so they can provide some sort of support, in addition we want the least traumatic procedure and least surgical time due to her medical problems.

The combination of removable partial denture (RPD) with an attachment design with fixed/removable precision attachment distribute the pullout force on the implant and the attachment equally, and worked as a guarantor that in case of implant failure the patient will still be able to use her RPD temporarily. Eventually, we reduced the risk on the implants during food mastication and denture removal by the unaware patient about the path of insertion, as she was pulling the denture in different directions. Patients treated with Implant-supported distal extension RPD combined with an attachment design can fulfill the requirements of patients' expectations like comfort, esthetics and function and secure durability.

CONCLUSION

Patients with resorbed mandibular alveolar ridge can be treated with several treatment modalities according to their own specific clinical situation. Implant supported removable dentures are the best solution for completely edentulous cases, while fixed

bridge with precision attachment provided support for distal extension RPD.

A combination of both treatment options, precision attachment combined with Implant-supported bilateral distal extension removable partial denture was a successful plan for cases with flat ridge and present anterior teeth. Randomized controlled trials with large samples are needed to better understand the efficacy of this treatment modality

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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