sciendo Acta Marisiensis - Seria Medica 2022;68(1):35-38 DOI: 10.2478/amma-2022-0003

CASE REPORT

Rehabilitation of maxillary arch with attachment-retained reinforced single complete denture

Oana Cella Andrei[1#], Daniela-Ioana Tărlungeanu[1#], Ruxandra Mărgărit[2], Gabriela Ciavoi[3*], Adriana Bisoc[1]

1. Department of Removable Prosthodontics, UMF Carol Davila Bucuresti
2. Department Of Restorative Odontotherapy, UMF Carol Davila Bucuresti
3. Department Of Dental Medicine, University of Oradea

Introduction: Fracture of maxillary complete denture is a common problem for dentists and denture wearers, occurring especially when it is opposing mandibular natural teeth or fixed and implant-sustained restorations; to prevent it, various methods and materials are available. **Case presentation**: This case is of a patient losing his old maxillary removable partial denture due to the mobility of the frontal abutments. Considering the age of the patient and the status of the mandibular arch, completely restored and having a mix of natural teeth, fixed and implant-sustained restorations, the functional and esthetic rehabilitation of the maxillary arch, and also the long-term resistance of the denture, are a serious prosthetic challenge. An association between ball attachments, metal-casted reinforcement and masking agents for both are described, underlying their role in the treatment's succes. **Conclusion**: The age and health status of the patient and the situation of the mandibular arch imposed the construction of a functional, strong and stable maxillary denture; the technique described in this article offers a good functional and esthetical result and benefits the patient, even if the implant-prosthetic therapy is not available.

Keywords: single overdenture, ball attachments, metal casted mesh reinforcement

Received 16 January 2022 / Accepted 5 March 2022

Introduction

Fracture of maxillary complete denture is a common problem for dentists and denture wearers [1], occurring especially when it is opposing mandibular natural teeth or fixed and implant-sustained restorations; to prevent it, various methods and materials are available. Single dentures not only fracture repeatedly; accelerate attrition of the artificial teeth, due to a higher hardness of the opposing natural dentition, is leading to a progressive loss of masticatory efficiency and of vertical dimension of occlusion, with functional and esthetic consequences [2].

If possible, retaining some of the natural teeth as abutments for an overdenture and reinforcing the denture base can improve its support, retention and stability, also maintaining some degree of proprioception and keeping a higher quantity of bone surrounding these roots. All these benefits are important for the psychological state and the quality of life of the patients. The retained roots can be used with or without attachments; the wide variety of those aim to accommodate almost any clinical situation. Still, the choice is not always simple, since the attachment housings will increase the risk of fracture due to the restricted vertical space above them and to the fact that they weaken the denture base.

The patient presented in this article lost his masticatory efficiency due to the instability of the prosthetic restoration of the entire maxillary arch; the class I Kennedy removable partial denture with sagittal ball attachments lacked stability and retention because of the accentuated mobility of the roots sustaining the frontal bridge.

Case presentation

The 63 years old male patient came to our office, having as chief complaint the mobility of the frontal maxillary bridge; the maxillary arch was previously prosthetically restored using a class I Kennedy removable partial denture retained with ball attachments. After the removal of the bridge sustaining the attachments, most of the abutments proved to be unrecoverable, due to their advanced periodontal pockets and mobility; only the two canines were in a better shape, and therapeutical measures (root planing, scaling and curettage) were quickly instituted, aiming for the reduction of the pocket depth.

The treatment plan took into consideration the status of the opposing mandibular arch; natural teeth, together with fixed and implant-supported prosthetic restorations (crowns) were present. Implant-supported overdenture was not accepted by the patient as an option because it was considered too expensive and time-consuming. The discrepancy between the clinical situation of the maxillary and mandibular arches was creating an unfavorable situation for the stability and retention of the maxillary single complete denture. After clinical and radiological examination (Figure 1.a), most of former abutments (1.5, 1.1, 2.1, 2.2) were found irretrievable and were extracted. No intervention was needed on the mandibular arch; the occlusal plane was found to be correct in what are concerned the level and direction (Figure 1.b). An immediate overdenture was manufactured using the old bridge and removable partial denture (Figure 1.c). Although, taking into account the situation of the mandibular arch, conserving any of the

* Correspondence to: Gabriela Ciavoi
E-mail: gabrielaciavoi@gmail.com
# These authors have equally contributed to the article.

maxillary teeth was considered mandatory; the two canine roots were planned to be used to improve overdenture's support, retention and stability and were prepared as such for occlusal ball attachments (Figure 1.d).

The precise parallel alignment of the two individual ball attachments was obtained using the analyzing rod of the parallelometer and the special ball gauge (Figure 2.a) in the waxing phase; the attachments were casted and tried in the patient's mouth before being returned to the laboratory (Figure 2.b). The preliminary impression for the single overdenture was made using irreversible hydrocolloid; the final impression was taken using poly-vinyl siloxane; the occlusal vertical dimension and the centric relation were registered using an occlusion rim, and the casts were mounted in centric relation (Figure 2.c). The trial denture was tested (Figure 2.d) without the reinforcement, which was manufactured separately from prefabricated wax, casted using a cobalt-chromium alloy and introduced in the trial denture after it was already tried in the mouth. Space for the denture base was maintained using the mucosal stops, so that all future base adjustments remain in acrylic resin.

In order to meet the esthetic expectations of the patient and to avoid the visibility of the metal, the reinforcement mesh was masked with a special agent (pink) (Figure 3.a); a layer of gingival colored ceramic was also used for the attachments to avoid the visibility of metal through the acrylate resin of the denture when smiling (Figure 3.b). Using ceramics to mask the attachments was not only an esthetical feature; it was also expected to improve the future clinical situation of the abutments, since dental plaque cannot attach easily to it, comparing to metal or natural teeth. The denture was finished using compression molding technique and a heat activated denture base resin. After polishing, it was inserted into the patient's mouth; mucosal and occlusal minor adjustments were made and hygiene and home-care instructions were provided, both for the denture and for the rest of the teeth. After a short period of wearing, the housings were attached to the denture using auto-polymerizing acrylic resin from the same manufacturer as the denture's base, for a perfect compatibility; the matrices strength was chosen to be normal (pink colored) (Figure 3.c). Due to the existence of the housings, they can be easily changed annually. The denture was successfully meeting the patient's esthetic and functional expectations (Figure 3.d).

Discussions

Loss of teeth seriously affects patients' self-confidence and quality of life. Although prosthetic implant treatments are increasingly being used currently, they are much more expensive, especially for restoring completely edentulous arches. The case presented here show a more cost efficient, but similarly good alternative for functionally restoring the maxillary arch, using modern retentive elements on the remaining roots of the patient incorporated in a reinforced overdenture.

A study that aimed to assess the effect of glass fiber-reinforced composite on the flexural load and flexural deflection of maxillary acrylic resin complete dentures strengthened with and without FRC reinforcement concluded that all of the reinforced dentures had higher flexural load and lower flexural deflection than the denture without reinforcement, regardless the location of the reinforcement [3]. Takahashi et al. compared three reinforcing materials (cast cobalt-chromium bar, glass fibers, and cobalt-chromium wire) which they incorporated within the acrylic base of a maxillary complete denture; their results suggested that a cast cobalt-chromium reinforcement helps to reduce the risk of fracture and deformation of a maxillary complete

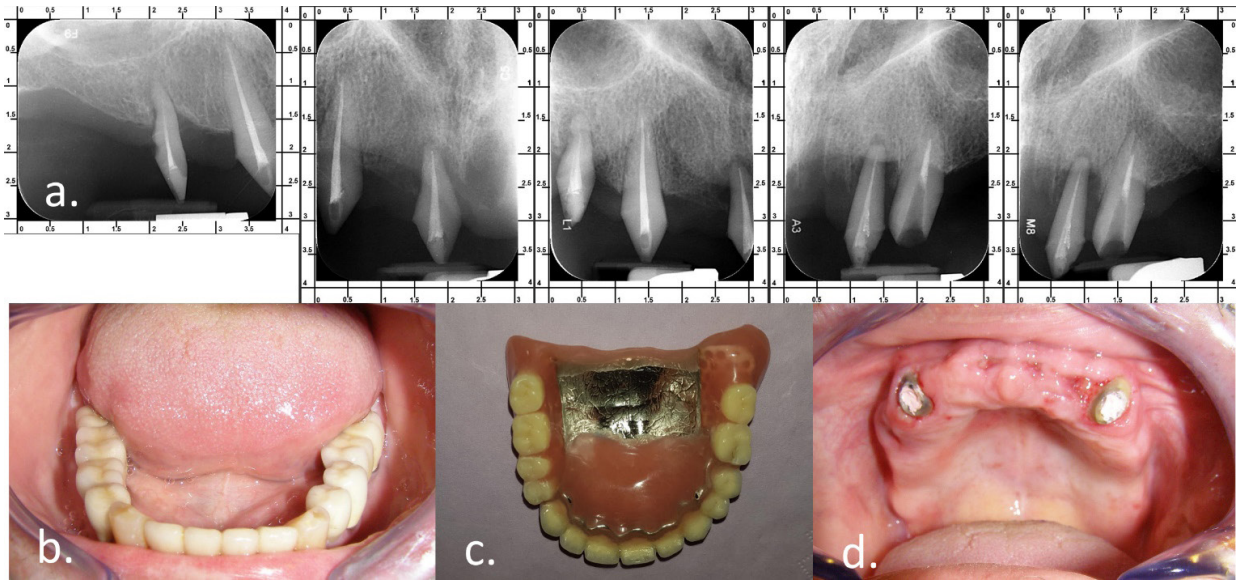

Fig. 1. Initial phases. a. Radiological examination of remaining maxillary teeth at presentation; b. status of the mandibular arch; c. the old removable partial denture completed to be used as provisional overdenture; d. clinical aspect of the remaining canines after the healing of the extractions.

Fig. 2. Working phases. a. Use of the parallelograph for waxing the attachments; b. position of the attachments on the functional model after try-in phase; c. casts mounted in centric relation; d. the trial denture and the sagittal space in occlusion.

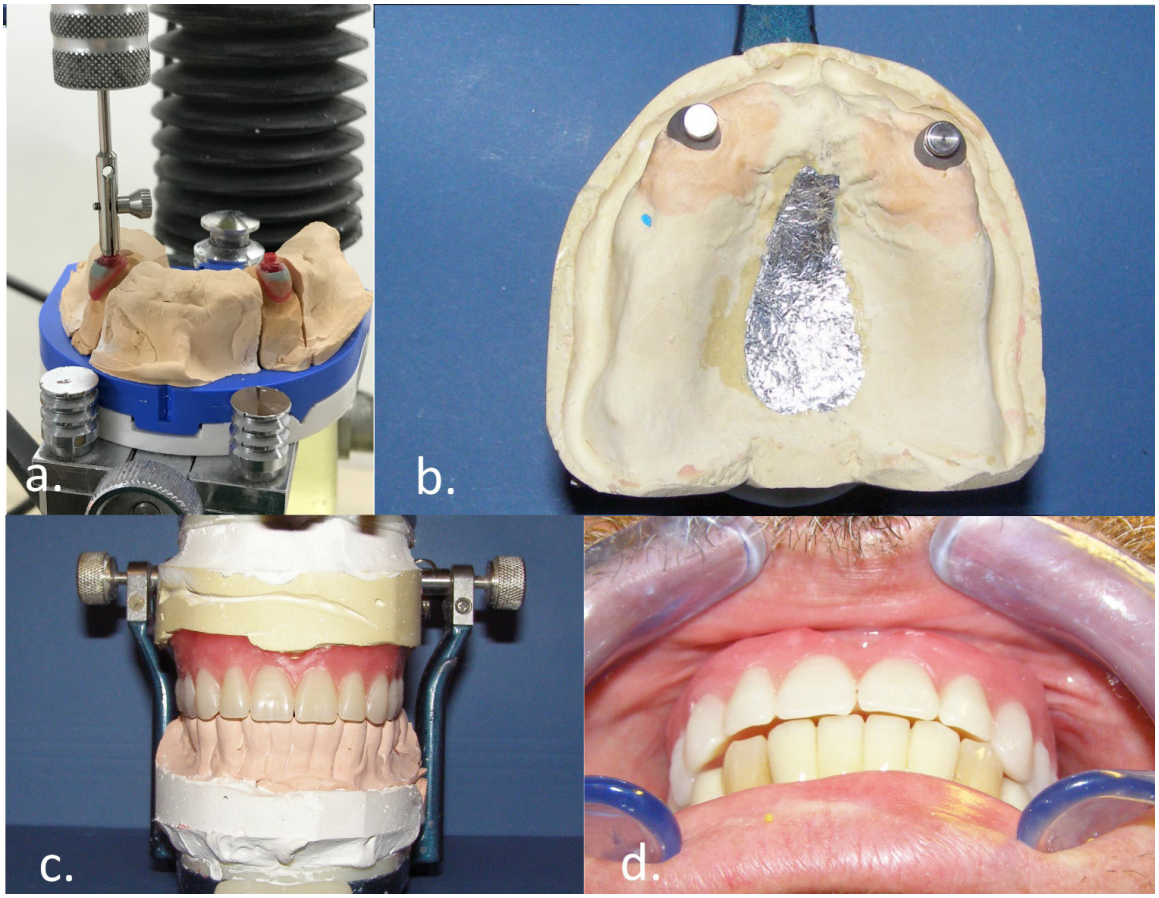

Fig. 3. Final phases. a. Esthetic appearance of the final overdenture; b. clinical aspect of the attachments cemented in the mouth; c. mucosal face of the denture showing the pink matrices and metallic housings; d. final aspect of the denture in occlusion.

denture [4]. In our case, we also preferred to use a cast cobalt-chromium reinforcement taking into count the somatic appearance and the age of the patient.

Calamote et al. found that the selection of the right reinforcement material must be made for each clinical case, based on the height of the alveolar ridge [5]. Nevertheless, it is obvious that a denture made on a high alveolar ridge will have a higher risk of fracture, being thinner than another one made on a low alveolar ridge. Another study realized by Yoshida et al. compared maxillary acrylic resin complete dentures reinforced with Remanium and without reinforcement and showed that the location of the metal reinforcement influenced their fracture resistance [6]. In the case presented, the careful evaluation of the vertical dimension of occlusion and accurate occlusal intermaxillary relationship registration were essential in ensuring there was sufficient vertical space for the metal housings.

The materials used for fixing the attachment housings may influence the flexural strength of PMMA denture base; polymethyl methacrylate-based materials are preferable [7]; heat-polymerized acrylic resin was found to offer a higher bond strength between housing and denture base resin [8]. In this case, we used auto-polymerizing acrylic resin from the same manufacturer as the denture's base, for a perfect compatibility and resistance and we decided to use OT Equator castable attachments in order to obtain the best retention of the overdenture at the minimum possible leverage on the sustaining roots [9].

Esthetics is highly affected by the manufacturing of a complete metal denture base or, furthermore, metal occlusal surfaces [10]; also, it does not allow further relining if necessary; we preferred the casted metal mesh reinforcement because it is strong enough to resist occlusal demands, it can be pink colored and then less visible and it is placed in the middle of the acrylic base, so relining is always possible.

For the long-term stability of occlusion [11], amalgam stops condensed in prepared resin teeth were considered an option, but they are also very unesthetic; in the presented case, in order to meet patient's both esthetic and functional requirements, we preferred to use nanofilled composite resin artificial teeth due to their high fracture toughness and high abrasion resistance [12].

Conclusions

The age and health status of the patient and the situation of the mandibular arch imposed the construction of a functional, strong and stable maxillary denture, objectives which were obtained by both the attachments and the casted metal mesh reinforcement, fabricated using a Co-Cr alloy; compared to the complete metal baseplate, its advantages are not only esthetic but also functional, since it allows the denture to be relined periodically as it is needed. Considering these aspects, the technique described in this article offers a good functional and esthetical result and benefits the patient even if the implant-prosthetic therapy is not available.

Acknowledgement

The informed consent of the patient has been obtained.

Authors' contribution

OCA (Conceptualization; Methodology; Writing - original draft;)
DIT (Data collection; Validation, Writing - review &editing)
RM (Data collection; Investigation. Methodology;)
GC (Conceptualization; Methodology; Investigation)
AB (Supervision, Visualization, Writing - review and editing)

Conflict of interests

Nothing to declare.

References

1. Jagger DC, Harrison A, Jandt KD. The reinforcement of dentures. J Oral Rehabil. 1999 Mar;26(3):185-94. doi: 10.1046/j.1365-2842.1999.00375.x. PMID: 10194725.
2. Koper A. The maxillary complete denture opposing natural teeth: problems and some solutions. J Prosthet Dent. 1987 Jun;57(6):704-7. doi: 10.1016/0022-3913(87)90367-2. PMID: 3295202.
3. Takahashi Y, Yoshida K, Shimizu H. Effect of location of glass fiber-reinforced composite reinforcement on the flexural properties of a maxillary complete denture in vitro. Acta Odontol Scand. 2011 Jul;69(4):215-21. doi: 10.3109/00016357.2010.549506. Epub 2011 Jan 31. PMID: 21281056.
4. Takahashi T, Gonda T, Maeda Y. Influence of reinforcing materials on strain of maxillary complete denture. Acta Odontol Scand. 2013 Mar;71(2):307-11. doi: 10.3109/00016357.2012.680903. Epub 2012 May 1. PMID: 22545819.
5. Calamote C, Coelho IC, Silva AS, Esteves JL, Moreira L, Pinto AC, Manzanares-Céspedes MC, Escuín T. Comparison of the Masticatory Force (with 3D Models) of Complete Denture Base Acrylic Resins with Reline and Reinforcing Materials. Materials (Basel). 2021 Jun 15;14(12):3308. doi: 10.3390/ma14123308. PMID: 34203948; PMCID: PMC8232668.
6. Yoshida K, Takahashi Y, Shimizu H. Effect of embedded metal reinforcements and their location on the fracture resistance of acrylic resin complete dentures. J Prosthodont. 2011 Jul;20(5):366-71. doi: 10.1111/j.1532-849X.2011.00720.x. Epub 2011 May 31. PMID: 21627707.
7. Ozkir SE, Yilmaz B. Effect of different housing retaining materials on the flexural strength of an acrylic resin overdenture base. J Prosthet Dent. 2017 Oct;118(4):500-503. doi: 10.1016/j.prosdent.2016.12.009. Epub 2017 Apr 3. PMID: 28385432.
8. Nakhaei M, Dashti H, Baghbani A, Ahmadi Z. Bond strength of locator housing attached to denture base resin secured with different retaining materials. Dent Res J (Isfahan). 2020 Jan 21;17(1):34-39. PMID: 32055291; PMCID: PMC7001568.
9. Cervino G, Montanari M, Santonocito D, Nicita F, Baldari R, De Angelis C, Storni G, Fiorillo L. Comparison of Two Low-Profile Prosthetic Retention System Interfaces: Preliminary Data of an In Vitro Study. Prosthesis. 2019; 1(1):54-60. https://doi.org/10.3390/prosthesis1010007
10. Radke UM, Gundawar SM, Banarjee RS, Paldiwal AS. The Single Complete Denture–A Case Report. International Journal of Clinical Dental Science. 2012 Jan 7;3(1).
11. Patil PG, Parkhedkar RD. Functionally generated amalgam stops for single complete denture: a case report. Dent Res J (Isfahan). 2009 Spring;6(1):51-4. PMID: 21528030; PMCID: PMC3075452.
12. Loyaga-Rendon PG, Takahashi H, Hayakawa I, Iwasaki N. Compositional characteristics and hardness of acrylic and composite resin artificial teeth. J Prosthet Dent. 2007 Aug;98(2):141-9. doi: 10.1016/S0022-3913(07)60047-X. PMID: 17692595.