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Overdenture Challenges - A Case Series Report from a Developing Country

Silas Mbeya Toka[1], Fredrick Ikhabi Weboko[1], Sharleen Chebet Langat[2], Mercy Naswa Makhanu[3], Peter Kuyaya Welime[1], Faith Chemutai Surtan[2], Felix Mbere Aswani[2], Benjamin Induswe[4], Grace Wangari Thuku[5], Faith Jebiwott Chemase[6]

[1]Department of Conservative Dentistry and Prosthetics, Moi University, School of Dentistry, P.O. Box 4606 – 30100, Eldoret, Kenya.
[2]Moi University School of Dentistry, P.O Box 4606-30100, Eldoret, Kenya.
[3]Department of Department of Community, Preventive Dentistry and Periodontology, Moi University, School of Dentistry, P.O Box 4606-30100, Eldoret, Kenya
[4]County Government of Vihiga, P.O. Box 344 – 50300, Maragoli, Kenya.
[5]Dental Care Dental Clinic, Nairobi, Kenya.
[6]Uasin Gishu County Referral Hospital, Eldoret, P.O. Box 40 – 30100, Eldoret, Kenya.

Corresponding Author: Fredrick Ikhabi Weboko

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ABSTRACT

Background: Overdentures generally provide superior treatment outcomes compared to conventional dentures. However, the satisfactory outcomes are associated with various challenges encountered by both the clinician during treatment as well as the patient during the use of the prosthesis.
Objective: This paper discusses the challenges encountered by dental practitioners in a developing country – Kenya, while managing eleven different patients and how these challenges were successfully mitigated.
Materials and Methods: Eleven patients had treatment done to restore function and aesthetics, utilizing acrylic and cast-metal overdenture prostheses, as was deemed appropriate, to mitigate various challenges.
Design: This is a case series. Herein, the clinical management of eleven edentulous cases, utilizing overdentures is illustrated.
Results: Limited vertical dimension of occlusion encountered in two patients with Amelogenesis Imperfecta, was mitigated by performing mock jaw registrations before the definitive prosthetic work. Limited maxillary ridge resorption encountered in three patients was mitigated by having the maxillary labial flanges in their narrowest dimensions, or placing the periphery of the denture below the height of contour. Denture bases were strengthened in four patients' prostheses by utilizing cobalt chromium frameworks on the mandibular overdentures. Telescopic crowns on overdenture prostheses fabricated over vital abutment teeth were utilized in three cases. Despite the prohibitive cost of treatment in developing countries, one patient had an implant-retained mandibular overdenture fabricated.
Conclusion: When a clinician is well-versed with the challenges to anticipate and how to overcome them, the use of overdentures yields satisfactory results for the patients.
Key words: Challenges, Overdentures, conventional dentures

INTRODUCTION

An overdenture is a removable dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of

natural teeth, and/or dental implants. From this very definition, it is apparent that challenges in providing the prosthesis may arise from the handling and survival of the remaining natural teeth, or from the treatment planning and placement of the implant fixtures and abutments. This case series report presents the challenges encountered in the management of eleven patients in a resource limited setting of a developing country.

METHODS

We present herein the challenges encountered in the management of eleven overdenture patients, treated in Eldoret and Nairobi, Kenya, and modalities employed in mitigating and managing those challenges.

1. Limited vertical dimension of occlusion

Perhaps the foremost challenge encountered in overdenture treatment is limited space onto which the prosthesis will fit. It is not uncommon for clinicians to proceed to jaw registration or try-in, only to conclude that the patient would not have adequate free-way space or worse still, would even lack space to accommodate the prosthetic teeth.

This challenge is mitigated by performing a mock jaw registration, immediately after the primary impressions, before any tooth preparations are carried out. If the result of this procedure reveals adequate space that would allow for a functional prosthesis, then, said tooth preparations are carried out. This is followed by a secondary impression, a subsequent definitive jaw registration, and finishing of the prosthesis, in most cases without a try-in.

This approach is particularly fitting for patients presenting with Amelogenesis Imperfecta. The clinician would want to ensure that the intended prosthesis would be successful, with minimal destruction to the underlying dentition, so that at the very least, if the prosthesis is not tolerated, then the patient may revert to their existing natural dentition. It is worth noting, that both the mock jaw registration, and the definitive one, are best carried out using wax occlusal rims on baseplate wax interim denture bases. This is outlined in the procedures carried out for the first two patients in this case series, both with an initial diagnosis of Amelogenesis Imperfecta, as outlined in figures 1 to 4 (below).

The denture set up for the patients entailed slight compromises in the placement of the acrylic teeth, in order to accommodate the underlying natural dentition (Figure 2). In both Amelogenesis Imperfecta cases, the resultant prostheses were successfully delivered with minimal preparation to existing dentition (Figures 3 and 4).

Figure 1: Jaw registration done for patient 1 (with Amelogenesis imperfecta), revealing adequate vertical dimension of occlusion with minimal tooth preparations necessary.

Figure 2: Denture teeth set-up for Patient 1, revealing alterations in individual tooth positions to accommodate the underlying dentition.

Figure 3: Before and after photographs of patient 1 with initial diagnosis of Amelogenesis Imperfecta.

Figure 4: Before and after photographs of Patient 2 with initial diagnosis of Amelogenesis Imperfecta.

2. Limited maxillary ridge resorption

The challenge of fabricating maxillary overdentures is especially compounded by the presence of maxillary anterior teeth, which in most instances implies that little or no bone changes have occurred to allow for the placement of an aesthetic labial flange. More often than not, the challenge with maxillary overdenture cases is excessive labial fullness.

This challenge was encountered in three cases in this case series; the aforementioned Amelogenesis Imperfecta cases, along with the case of a middle-aged female with only the maxillary anterior teeth left.

In the case of the first Amelogenesis Imperfecta patient, the labial flange was

fabricated to its narrowest dimension, with an actual perforation resulting in one of the prominences of the maxillary alveolar ridge (Figure 5). In the second Amelogenesis Imperfecta case, the maxillary labial flange was contoured below the height of convexity of the alveolar ridge, resulting in some semblance of a gum fit prosthesis (Figure 6).

Figure 5: Aesthetic perforation (indicated with an arrow) on the labial flange of the maxillary overdenture of patient 1, to prevent an over-bulge of the upper lip that would otherwise be unaesthetic.

Figure 6: Reduced extent of the maxillary flange of the overdenture of patient 2, to accommodate the non-resorption of the maxillary alveolar ridge.

In the third maxillary overdenture case, the decision to actually fabricate one was arrived at after an acrylic removable partial denture that was initially fabricated was ill-retentive. This was due to the fact that the only teeth present on the maxillary arch were the 13, 12, 11, 21 and 22. These teeth could not be clasped due to aesthetic considerations and there were unfavorable undercuts around their roots that precluded adequate utilization for removable partial denture retention. The decision was thus made to root treat the remaining maxillary teeth, and utilize them as overdenture abutments (Figure 7).

Figure 7: Overdenture abutments of Patient 3, showing root-treated 13, 12, 11, 21 and 22, with decoronated crowns left at the gingival level.

The value of maintaining the maxillary anterior teeth as overdenture abutments was compounded by the presence of a corresponding mandibular overdenture for the same patient. Extraction of these remaining maxillary anterior teeth, followed by fabrication of a conventional complete maxillary denture, opposed by a mandibular overdenture, may have predisposed the patient to the possibility of combination syndrome in due course.

Fortunately for this case, the aesthetics of the labial flange of the final overdenture, although being restricted to a very narrow thickness, was still acceptable without under-contouring or perforating, due to the patient's natural lip fullness (Figure 8).

Figure 8: Photograph of final prosthesis of patient 3, showing acceptable labial fullness despite full extent of the maxillary labial flange.

3. Multiple fractures of the mandibular denture base

The mandibular overdenture is particularly susceptible to fracture when fabricated entirely in acrylic. The area of the denture overlying the abutment teeth typically has a region of reduced dimension of the acrylic base. That, compounded by stress concentration over the overdenture abutment copings, presents with possibilities of fracture on the mandibular denture.

This was observed in patient 3, 4 and 5 in this case series. For these patients, the first set of fabricated prostheses were made of acrylic. After a number of months in service, the mandibular dentures for these patients all fractured around the abutment teeth regions. Figure 9 shows the fractured mandibular acrylic denture for patient 4.

Evaluation of the repaired mandibular acrylic overdentures for these patients revealed loss of support in the posterior regions of the dentures, distal to the abutment teeth. It was postulated that after the duration of several months of mandibular overdenture use, there was bone resorption in the region of the edentulous saddle that gave the denture tissue support. It was further postulated that the anterior region of the arch experienced less bone remodeling due to the presence of the overdenture abutment teeth, offering tooth borne support to the prostheses in these regions. Thus, with the passage of time, there developed a fulcrum point about the overdenture abutments, leading to denture fracture at these points.

Figure 10 shows the overdenture abutments for patient 4. The consistent fracture point was above the abutment Cobalt chromium crown coping on the 35. This abutment tooth is much longer in its occluso-gingival dimension compared to the other distal abutment, the 43. Thus, the fulcrum effect on this abutment tooth was much more pronounced compared to that on the contralateral side. That notwithstanding, provision of the height of the abutment crown coping was dependent on the initial status of the crown of the tooth before root canal therapy, and need for secondary retentive features provided by abutment crown copings of a longer occluso-gingival dimension.

Figure 9: Fractured mandibular overdenture for patient 4.

Figure 10: Overdenture abutments on the mandibular arch of patient 4.

The challenge of recurrent fractures of the mandibular denture base was initially mitigated by reline procedures undertaken in a bid to compensate for the residual alveolar bone resorption in the distal saddles. However, the challenge still remained despite the reline procedures, as the area overlying the abutment teeth still had thin acrylic.

Fabrication of mandibular overdentures, reinforced with a Cobalt chromium framework within the structure proved to be a more definitive way of addressing this challenge.

A number of strategies were employed in the fabrication of the mandibular overdentures with the metal framework reinforcement. For Patient 4, the Cobalt chromium framework was fabricated first from the mandibular master cast derived from a secondary impression taken using low fusing impression compound (Kemdent Tracing Sticks, Associated Dental Products Ltd Kemdent Works, Purton, Swindon Wiltshire, United Kingdom), and Zinc oxide Eugenol impression paste (SS White, SS White Group, C/O Prima Dental Group, Gloucester, England), as shown in Figure 11. The framework was immediately acrylized and subsequent clinical procedures; jaw registration, and try-in, were carried out on the definitive denture base.

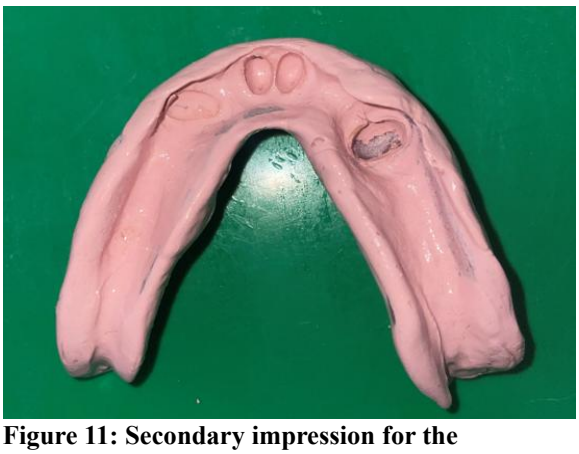

Figure 11: Secondary impression for the mandibular arch of patient 4.

For Patient 3, the mandibular denture was made conventionally in acrylic and processed entirely in acrylic. Thereafter, a cast metal framework was fabricated and processed together with the definitive denture base by cutting back into the polished surface of the completed denture and carrying a processing procedure similar to a denture reline, to incorporate the metal reinforcement.

For Patient 5 and 6, the Cobalt chromium framework was left in contact with the tissue, as the mandibular overdenture was fabricated in a manner similar to the fabrication of cast-metal removable partial dentures. Figure 12 shows the fitting surfaces of the mandibular overdentures for patients 3, 4, 5 and 6.

Figure 12: Fitting surfaces for Cobalt chromium framework reinforced mandibular overdentures for patients 3, 4, 5 and 6.

4. Pre-prosthetic preparation in geriatric patients

Overdenture fabrication requires significant pre-prosthetic treatment which typically includes periodontal, endodontic and restorative treatment, before the prosthetic treatment can be carried out. The chairside time implications for such treatment takes a particular toll on geriatric patients.

Patient 7 in this case series was in her 7th decade of life during the process of this dental treatment, whereas Patient 5 was in her 10th decade of life. Both patients had to undergo hours of endodontic treatment to prepare their teeth to be overdenture abutments. Figure 13 shows the pre-treatment and the post-treatment orthopantomogram radiographs for patient 7. It illustrates the sheer volume of dental treatment that the patient had to undergo in order to achieve the final results, depicted in Figures 14.

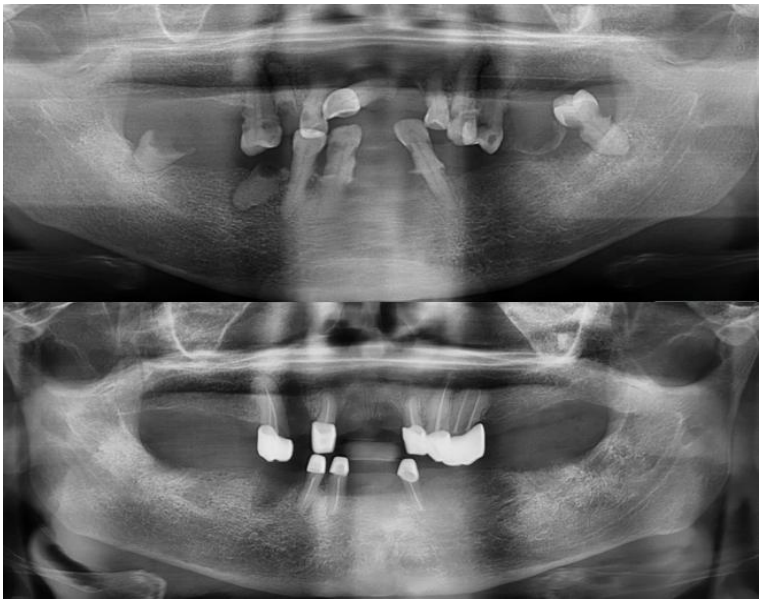

Figure 13: Pre- and post-treatment orthopantomogram radiographs for patient 7.

Figure 14: Treatment photographs illustrating volume of dental treatment done for Patient 7 to achieve final results.

Figure 15: Photographs showing the final prostheses for patients 5 and 7, both geriatric patients who had to undergo extensive pre-prosthetic dental treatment.

5. Utilization of vital teeth as overdenture abutments and limited room for further tooth reduction

Rarely would a clinician intentionally select vital teeth to be transformed into overdenture abutments.

That this is a challenge presented in this case series supposes that the cases managed with said challenge had special considerations.

Patients 8, 9 and 10, all presented with failed fixed partial dentures, which had been designed with flawed principles, notably, contravention of Ante's Law. Prudence dictated that the failed fixed prostheses could neither be recemented, nor re-fabricated. A viable prosthetic treatment option was overdenture fabrication.

For Patient 8, an acrylic removable partial overdenture with telescopic crowns over the prepared vital abutment teeth, was fabricated as an interim prosthesis. Definitive management with implant retained crowns replacing the missing teeth and full coverage crowns over the prepared teeth was envisioned.

Patient 9, presented with a failed four-unit fixed partial denture replacing the 11 and 21, with the 12 and 22 as abutments. An overdenture was fabricated as a long term interim prothesis, utilizing a Cobalt chromium framework to enhance the strength of the denture base. The amount of space between the overdenture teeth and the mandibular teeth necessitated the use of the metal reinforced base, since an acrylic denture of similar dimensions would have sustained certain fracture.

For Patient 10, definitive management was achieved using a mandibular overdenture prosthesis with acrylic telescopic crowns over the prepared vital abutment teeth. The overdenture had a cast-metal Cobalt chromium framework. Patient comfort (with no tooth sensitivity complaints) was achieved with the overdenture as a definitive prosthesis since the initial tooth preparations had been conservative. It was also possible that reparative dentine had formed within the prepared teeth, coupled with the fact that the patient was elderly, and so, the larger pulp chambers noted in younger individuals was less of a concern. The orthopantomogram radiograph for patient 10 is shown in Figure 19.

Figure 16: Image of failed fixed prosthesis and the replacement interim acrylic removable partial overdenture for patient 8.

Figure 17: Prepared vital 11 and 13 with missing 12 and 14, and an extensive maxillary midline diastema, corrected by the interim acrylic removable partial overdenture for patient 8.

Figure 18: Removable partial overdenture prosthesis for patient 9, replacing the 11 and 21, with acrylic telescopic crowns over the 12 and 22, and a Cobalt chromium reinforced baseplate.

Figure 19: Orthopantomogram view for patient 10, showing prepared 33, 35, 43 and 45, which show no peri-radicular changes, and were symptom free clinically.

Figure 20: Definitive mandibular Cobalt chromium cast-metal removable partial overdenture with acrylic telescopic crowns over the 35, 43 and 45, for patient 10.

6. Prohibitive cost of treatment for overdenture patients

It goes without saying that for a developing country like Kenya, dental treatment cost is a challenge for many. Conventional overdentures are still costlier than conventional dentures as they entail an added cost of abutment treatment. Implant overdentures present an internationally accepted modality of restoration of the edentulous mandible, with at least two implants placed in the inter-foramina region, being touted as what is supposed to be the standard of care.

Patient 11 in this case series had these principals of the Mc Gill's Consensus Statement applied in her treatment [1].
The treatment outcome was satisfactory with relatively no intra-operatory challenges, except for the aspect of cost of treatment. Figure 20 shows the treatment outcome for patient 11.

Figure 21: Mandibular implant overdenture for patient 11.

DISCUSSION

The use of tooth or implant retained overdentures as a treatment modality in edentulous or partially dentate patients, falls under the tertiary level of preventive prosthodontics. When tooth supported, these prostheses reduce the rate of residual alveolar ridge resorption and provide proprioception in the periodontal ligaments. The use of implant supported overdentures also have a similar effect on the residual alveolar ridge as compared to the traditional tissue supported dentures [2]. In addition to the biologic advantages conferred by these prostheses, superior retention and stability are achieved especially in the mandible. However, despite these advantages, literature cites more disadvantages than advantages when using these prostheses [3,4]. This case series discusses these disadvantages and how to overcome them.
In our economic background as a developing country, the cost of these prostheses presents a challenge in delivery of treatment especially since the conventional tissue-supported dentures are less costly than both tooth and implant supported overdentures. The adjunctive endodontic treatment required on the abutment teeth presents an additional financial cost which makes most patients to opt for conventional dentures even in cases when overdentures would have provided superior treatment results. The additional laboratory expense associated with the fabrication of the cast metal copings may impact the decision to use copings on the abutment teeth. These copings contribute significantly to a decrease in the incidence of dental caries on the abutments.
In cases with limited vertical dimension of occlusion, such as in Amelogenesis Imperfecta, and after loss of natural teeth, proper clinical evaluation of the patient is key before the treatment begins to evaluate the viability of overdentures as an effective treatment option as well as to avoid setbacks during later stages of the treatment. This also helps to determine the type of tooth abutment to be used – whether long or short, as well as abutment attachment systems in implant supported overdentures.
To strengthen the acrylic denture bases and decrease the incidence of fracturing, reinforcement can be done using either metallic and nonmetallic materials. Metallic reinforcements that can be utilized include cast Cobalt chromium, prefabricated stainless-steel mesh, and metallic wires.

Glass and polyethylene fibers are the nonmetallic materials presently used for this purpose. These reinforcements have a higher modulus of elasticity thus the forces imparted on the denture base during use are absorbed by the metallic and non-metallic materials without interfering with its structural integrity [5]. With continued use, the acrylic base becomes porous and has decreased flexural strength. This necessitates replacing the denture base over time in order to maintain its functional efficiency and mechanical properties.

To increase the longevity of these prosthesis, patients need to be recalled on a regular basis. This allows the clinician to assess and treat any issues that may emerge. Any complaints voiced by the patient should be addressed in order to ensure the patient's comfort. The most frequently encountered complications with the use of such prosthesis are gingival inflammation and dental caries [6]. Both oral and denture hygiene instructions and motivation should be reinforced during every visit. Topical fluoride should be applied on the abutments especially when they have not been covered by a metallic coping.

CONCLUSION

When a clinician is well-versed with the challenges to anticipate and how to overcome them, the use of overdentures yields satisfactory results for the patients.

Ethical considerations

Verbal consent to take clinical pictures and use them for teaching and research purposes was obtained from the patients. Clinical pictures showing patients' faces have the eyes obscured to protect identity and privacy. Confidentiality and anonymity were ensured by omitting the identities of the patients.

Declaration by Authors

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