Case Report

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Managing Unilateral Maxillary Defect Problems with Developed Metal Frame Designs. A Report of Three Cases

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ABSTRACT

The treatment of unilateral maxillary excision with a metallic frame obturator presents challenges primarily because it is difficult to address both stability and retention requirements, along with aesthetic considerations. These concerns stem from the involvement of the central or lateral incisor teeth, as well as the visible nature of the traditional clasps utilized. Three designs were developed to address efficient retention and stability; at the same time, the gingival and periodontal health were maintained by splinting the teeth and through gingival protection around the abutment teeth. Anteriorly adding a proximal labially extended plate can improve stability, retention, and looks. However, the undesirable appearance of the metal needs to be corrected. This report proposes and implements a simple strategy for restoring three patients with extensive unilateral maxillary abnormalities utilizing Co-Cr obturators. This type of design approach yielded very encouraging results, particularly because it addressed aesthetics, gingival protection, and other mechanical aspects of the prostheses without additional cost. The patients and the dentist both expressed satisfaction with the outcome.

Keywords: Unilateral Maxillectomy; Design for Maxillectomy; Aesthetics; Metal Frame for Maxillectomy

Introduction

Maxillofacial prosthodontists encounter various challenges when addressing certain types of maxillary defects. These tasks can vary based on the extent of mutilation, the configuration of the remaining oral structures, and the need for ongoing medical observation. Unilateral maxillectomy is usually performed to eradicate tumors in the nose, paranasal sinuses, or oral cavity if they are malignant or benign. The most common malignancy in the oral cavity is squamous cell carcinoma (SCC). Other cancers of the nose, paranasal sinuses, or oral cavity that spread to the maxilla may necessitate bone removal plus the soft tissues. Invasive infections that fail to respond to medication, chronic osteomyelitis, severe trauma due to road accidents, odontogenic cysts, and some rare granulomatous lesions are other causes of radical oral surgery [1]. The consequence is a maxillary deficiency that extends from the maxillary bone to the sinuses, nasal cavities, orbits, and sometimes, the nasopharyngeal area [2]. The defect may be unilateral or bilateral with small remaining portion of the maxilla (subtotal maxillary deficiency). In most cases, the defect should be repaired surgically or with a prosthetic appliance that allows for continuing monitoring and inspection of the rudimentary tissues after tumour ablation surgery, with the goal of detecting recurrence early and adopting the necessary measures.

The maxillary defect may include the alveolar ridge, its connected teeth, and the palatal area, depending on the extent of the lesion and the tissue clearance around the location. The absence of anterior teeth, particularly the central and lateral incisors, presents both challenging and costly treatment options for patients and practitioners. Restoring the defect with an obturator featuring a metal framework to replace one or more anterior teeth may lead to aesthetic concerns, and patients might decline this option due to the visibility of traditional clasps. Various solutions exist to address this challenge. For example, omitting the clasp on the anterior teeth makes the frame less retentive and stable, adding to the critical situation in the case of unilateral maxillectomy obturators. In addition, the acrylic obturator cannot offer good biomechanical features like metal obturators that are considered a definitive replacement and provide better biocompatibility because of the material used in fabrication, like Co-Cr alloys [3]. While the Co-Cr obturator has excellent properties, its appear-

ance does not align with the colour and texture of oral tissues and gingiva. This issue forces the practitioner to adjust the frame design every time portions of the anterior teeth are replaced, resulting in lower retention and an unstable design.

Alternatively, practitioners may recommend a costly nonconservative treatment, which could involve removing the clasps or utilizing complex procedures such as precision attachments, telescopic crowns, or a suitable type of nonrigid design [4-11]. The aim of this clinical report is to show alternative successful designs of metallic obturators for a unilateral maxillary defect with some missing anterior teeth. Two cases with unilateral maxillary postsurgical defect were treated by Co-Cr obturator. The last one of the cases was corrected surgically using bone craft before the prosthetic restoration (Table 1). A simple modified design for each case was fabricated to match the color and appearance of the visible area of the framework, restoring the defect and replacing the front teeth while maintaining flawless retention, stability, and protecting the gingival tissues by minimum gingival covering around the abutment teeth.

Table 1: The information of the three patients.

Information	Patient 1	Patient 2	Patient 3
Age	35 years	52 years	23 years
Profession	factory operator	Not specified	Store keeper
Gender	Women	Man	Man
Health status	Normal	Normal	Normal
Cause of defect	Mucoepidermoid tumor removal	Squamous cell carcinoma removal	Motor bike accident
Defect	Unilateral maxillectomy	Unilateral maxillectomy	Unilateral maxillectomy
Nose-mouth status	Oro-nasal communication	Oro-nasal communication	Closed by corrective surgery
Soft palate	Intact	Intact	Intact
Status	Teeth are healthy	Teeth are healthy	Teeth are ±healthy
Prosthesis	Temporary obturator	Temporary obturator	Acrylic denture
Complaints	Water, food, and air leak	Water, food, and air leak	Reduced function

The First Patient

A 35-year-old woman working as a factory operator visited the clinic to address issues with her interim obturator, which allowed water and food to escape into her nasal cavity. She was operated on in the ear-nose-throat department six months ago to remove a mucoepidermoid tumour. Her interim obturator had many functional deficiencies. Examination revealed the presence of naso-oral communication due to unilateral resection of the maxillary arch, leaving the contralateral half of the arch intact and dentate (Figure 1). The right central incisor, lateral, canine, and posterior teeth were present in a healthy condition. The decision was made to construct a Co-Cr obturator (Figure 2). The teeth were prepared to receive multiple rests and the guiding plane of the future obturator. A primary impression was made using irreversible hydrocolloids (Aroma Fine Plus Alginate Impression Material, GC) and a stock tray. The conventional technique of protecting the defect area involved using gauze impregnated with petroleum jelly. For added safety, the gauze was secured to a silk thread extended outside the mouth. A preliminary cast was poured in dental stone (New GC Fujirock). An individual tray was fabricated using auto-polymerizing acrylic resin (Resin LS Self-Curing Acrylic Die Material). It was checked and corrected inside the patient's mouth using impression compound type I (SDS Kerr, Kerr Corporation) to record the tissues' compressibility around the defect and the border extensions.

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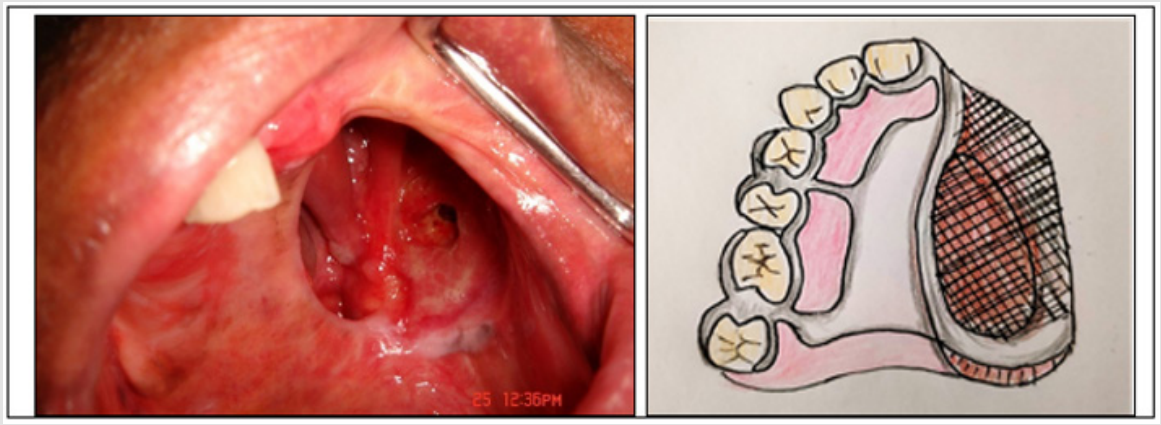

Figure 1: The maxillary defect area and the approved design of first patient.

Figure 2: The trail obturator showing the front guiding plate.

The secondary impression was made using medium viscosity vinyl siloxane (Exaflex, regular, GC). The impression was beaded, boxed, and poured using dental stone (Whipmix Stone Microstone Premium labstone). A Co-Cr (Wironit, Bego Bremer Goldschagerei Wilhi) metallic frame was cast, completed following the normal casting protocol, and checked inside the patient's mouth. An enhanced design of the obturator was arranged to solve the problems associated with this defect. The stability and retention were ameliorated using butterfly clasps and a continuous cingular and coronal bar to splint the residual teeth and to distribute loads over the remaining teeth efficiently [12]. Gingivae uncovered widely around the remaining teeth following the bioprotective concept [13,14] were applied to protect the gingivae around the teeth and allow self-cleansing action. The design was shown in (Figures 1 and 2). A proximal plate labially extended was used to enhance the retention and stability of the framework without disfiguring the anatomy of the tooth's labial profile and the interproximal gingival contour, also to prevent further displacement of the central incisor. The location was on the mesial proximal surface of the central incisor and extended nearly 1-1.5 mm of the labial tooth surface. The intermaxillary relation was checked, and teeth were selected and arranged. The trial obturator was checked in the normal way.

A wax layer of sufficient thickness (Metrowax—modelling waxes) was used to match the gingiva form around the central incisor and the prosthesis flange (Figure 3). The trial prosthesis was then flasked, deflasked, and processed into heat-cured acrylic resin (Acron Duo). The final prosthesis was finished, polished, and delivered to the patient under the same common protocol in addition to testing the air, water, and food leakage through the nose during functional tests. The appearance was very natural; no clasp or metal extension was visible, and the discontinuity of the flange border was invisible. The guiding plate can be covered using gingiva shade-matched acrylic (Secret® Acrylic Tint) as an alternative in case of improper colour matching using the normal pink acrylic resin. The patient was very satisfied with her new obturator. (Figure 3).

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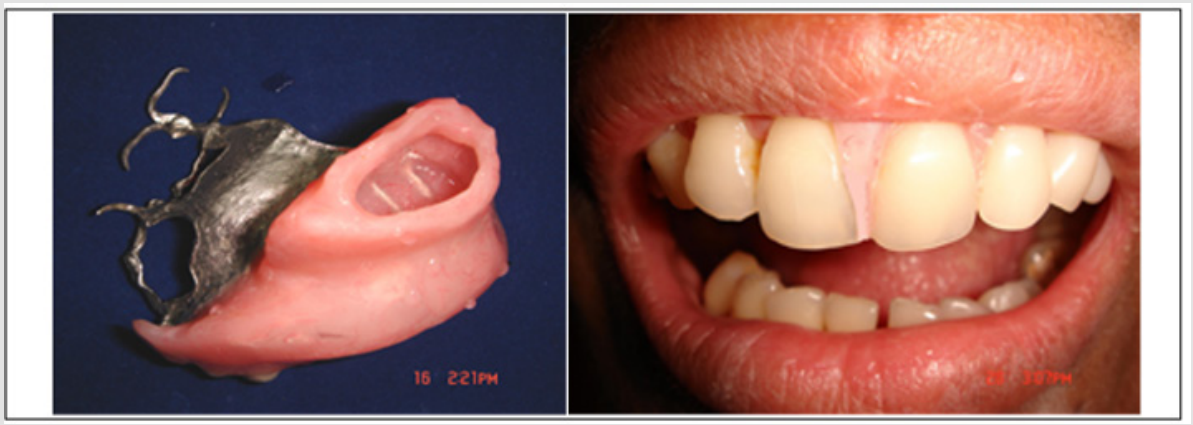

Figure 3: The finished obturator.

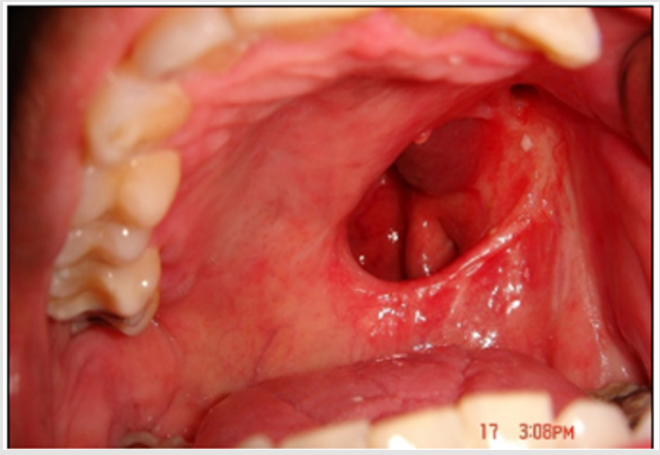

Figure 4: The second case defect.

The Second Patient

A 52-year-old man came to the clinic complaining of pain in the alveolar ridge and nose, as well as air and fluids leaking through the nose due to an old, temporary obturator. He was operated on to remove squamous cell carcinoma (SCC) from the hard palate and the left side of the maxillary arch. The intraoral examination indicated a naso-oral connection due to the removal of the alveolar ridge, affecting nearly half of the hard palate. The old obturator had insufficient seal and extension inside the defect, was poorly adapted to the peripheral tissues, and caused pain. The defect extended from the left canine to include the left side of the hard palate and the whole left alveolar process, with the teeth (Figure 4). A preliminary impression was made for the patient using a stock tray and irreversible hydrocolloid (Aroma Fine DF III, GC Corp., 76-1 Tokyo, Japan). It was poured on stone. The design was prescribed taking into consideration the biomechanical features of the residual tissues, the old obturator deficiencies, and the proposed amelioration (Figure 5). The abutment teeth were prepared for rests, guiding planes, and indirect retainers. An individual tray was fabricated using auto-polymerizing acrylic resin (Meliodent, HK). Then, the secondary impression was made using impression compound (SDS Kerr, Kerr Corp., Japan, NC) and siloxane (Exaflex, regular, GC America Inc., ALSIP, IL). Beaded, boxed, and poured by stone. The metal frame was fabricated and finished following the normal procedures.

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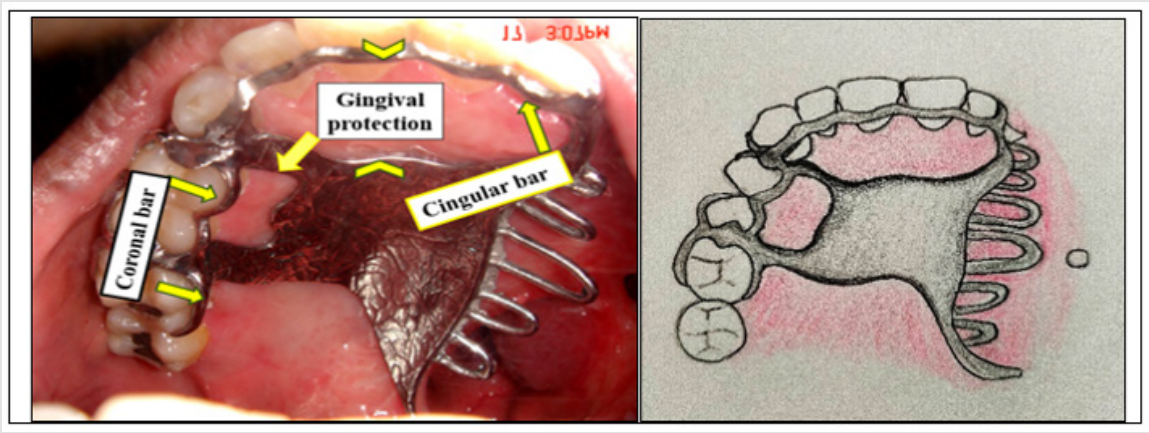

Figure 5: The details of framework design.

Figure 6: The finished obturator inside the second patient with the matched guiding plate on lateral incisor.

The Co-Cr obturator was designed with a labial guiding plate extension on the lateral incisor, like the previously described case. The frame was waxed, the intermaxillary relation was recorded, and the teeth and occlusion were checked during the tray-in stage. The guiding plate was covered by acrylic resin matching the gingiva colour and texture. The finished obturator was delivered to the patient after checking the mechanical properties (Figure 6). It was retentive, stable, well-adapted, and very aesthetically pleasing, sealing the naso-oral communication and preventing fluids and food from escaping through the nose during functional tests. The patient expressed his complete satisfaction.

Figure 7: The defect of the third patient.

The Third Patient

A stock keeper, aged 23 years, was referred for prosthetic restoration of his missing teeth and part of the alveolar bone. The examination and interview of the patient revealed a history of a motorcycle accident that ended with a missing part of the left side of the hard palate, the alveolar ridge, and the related teeth. The area was repaired surgically using a bone graft from the iliac crest and a tissue flap from the temporalis area. The hard palate was irregular and deeper on the repaired side. In addition, the remaining posterior segment of the alveolar ridge was slightly movable, supporting the first and second molars. The right side of the arch maintained the maxillary central, canine, premolars, and molars in healthy condition but slightly maloriented (Figure 8). On the mandible, the teeth were present only on the right half. Therefore, due to the current clinical situation, two important objectives should be addressed: the long, unfavorable supportive edentulous area and the anterior location that needs special attention. The decision was to fabricate a well-stabilized partial denture with a simple modification anteriorly, like in the previous cases, to enhance the aesthetic and to protect the remaining movable alveolar segment. The framework was primarily supported and retained by the healthy teeth on the intact side of the arch, while the operated side and palate were covered to the greatest extent possible, with only the first molar (due to its inappropriate location) serving as an anchorage for stability and minimal retention to reduce torque and pressure (Figure 8).

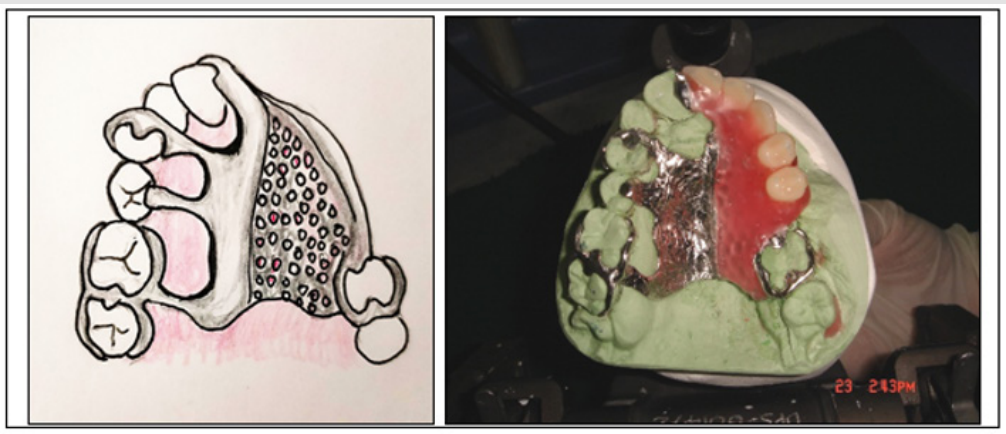

Figure 8: The design of third case defect and the trail obturator.

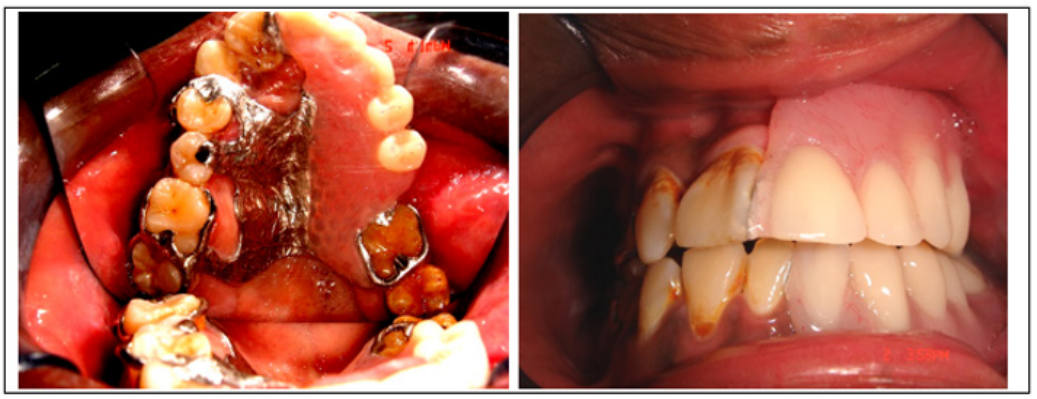

Figure 9: The prosthesis inside patient mouth and the modified guiding plate appearance.

The framework was fabricated in the conventional way. On the anterior region a labially extended plate was added, as in previous cases. The prostheses were delivered to the patient following the conventional norms of inspection for partial dentures. The biomechanical features of the prostheses were retentive, hygienic, and promoted self-cleansing. The final aesthetic was acceptable for the patient and the dentist due to the presence of permanent cervical staining that needs additional bleaching treatment to enhance the appearance result.

Discussion

Unilateral maxillary defects, due to the remaining structure configuration, often present a range of functional, mechanical, and aesthetic challenges that require extra attention from the practitioner to meet the patient's needs [13]. This report examined and treated three patients with varying degrees of mutilated maxillary arches and detailed their treatment approaches. The need for improved self-cleansing design, stability, retention, and a complete seal of the opening was thoroughly analyzed and discussed in relation to the available resources of both the patients and the clinic, ensuring that the best treatment was provided. The concept of gingival protection, or bioprotective principles, is not new [13,14]. However, the concept took a long time to show its application for variable oral rehabilitation situations. To apply this method successfully, the design of the framework needs enhanced strength of the minor connector to support the repeated flexibility due to masticatory forces (Figures 1, 5 & 8). Considering the aesthetic needs of the patients, a simple and cost-effective solution was proposed to address the aesthetic issue. The appliance's flange discontinuity in the anterior area, as well as the necessity for retention and stability, is never addressed by removing the clasp from the frontal teeth. As a result, adding a gingiva-matching guiding plate that covers the proximal and 1-1.5 mm of the labial tooth surface was a simple, cost-effective way to provide acceptable aesthetics in such a setting while preserving the prosthesis' mechanical properties.

To enhance the acrylic attachment to the metallic plate, retention grooves, small wax balls, or a rough surface can be made on the wax model of the modified guiding plate. The disadvantages of this method are the liquid permeability underneath the acrylic layer and the need for repair from time to time. However, replacement or repair is very easy and affordable when it happens and can be done in-clinic without the patient waiting for a long time.

Conclusion

Three metallic forms of prosthesis were offered for three patients: two with unrepaired unilateral maxillectomy and the other one with a corrected defect. The approach addressed the most typical concerns associated with two unilateral maxillary deformities, as well as the additional requirement for force distribution related to a difficulty with the maxillary base in the third example. The prosthesis promoted self-cleaning properties, stability, retention, and cosmetic enhancement. The issue of colour matching for the guide plate using acrylic resin is easy to manage at any time and at a minimal cost.

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