

Prosthetic Rehabilitation of the Soft Palate: A Major Functional Challenge

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How to cite this paper: Rimaoui, S., Ellassraoui, K., & Bellemkhannate, S. (2025). Prosthetic Rehabilitation of the Soft Palate: A Major Functional Challenge. *Voice of the Publisher*, 11, 332-341.

<https://doi.org/10.4236/vp.2025.112024>

Received: April 28, 2025

Accepted: June 13, 2025

Published: June 16, 2025

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Abstract

The dynamic movements of the velopharyngeal sphincter are a complex motor mechanism requiring coordination between the soft palate and the lateral and posterior walls of the pharynx. Lowering the soft palate allows the oropharynx and nasopharynx to open simultaneously, facilitating normal nasal breathing. On the other hand, certain functions, such as swallowing or the pronunciation of certain phonemes, require complete or almost complete velopharyngeal closure or a modulated opening according to functional needs. Any alteration in this mechanism can have a profound effect on various functions, in particular phonation disorders (manifested by hypernasality and unintelligible speech), dysphagia and air and fluid leakage. The aim of this article is to describe the prosthetic management of a patient with a velar defect following surgical resection of a tumour process, highlighting the constraints encountered and the specific features of this clinical situation.

Keywords

Maxillofacial Prosthesis, Velar Defect, Velopharyngeal Obturators

1. Introduction

The soft palate is a flexible fibromuscular septum containing accessory salivary glands. Unlike the hard palate, the soft palate is contractile, giving it the mobility necessary for certain oral and pharyngeal functions. It averages 3 to 4 cm long, 6 cm wide and 1 cm thick, extending into a midline structure.

Loss of the velar substance can be congenital or acquired. Congenital forms mainly include unilateral or bilateral, total or partial cleft lip-alveolo-velo-palate, often observed in neonates. Acquired velar defect is most often of tumour origin and less commonly of traumatic or infectious origin (Destruhaut et al., 2014).

The resulting palatal-pharyngeal insufficiency has significant functional conse-

quences, such as hypernasality, inappropriate nasal leakage and reduced intra-oral pressure when producing high-pressure consonants (Agrawal et al., 2011).

Swallowing difficulties are also observed due to the critical role of the soft palate, which acts as a lid, closing access to the nasopharynx and directing the bolus of food towards the hypopharynx.

The psychological impact of these changes should also be emphasised, which can be profound, leading to malaise, withdrawal and, in some cases, depression accompanied by social isolation.

Despite the remarkable progress that has been made in the surgical treatment of velar defects, these operations cannot always be envisaged. On the one hand, they do not systematically provide a complete and satisfactory repair, and on the other hand, they are not always indicated due to the patient's general state of health or certain clinical constraints.

In this context, maxillofacial prostheses continue to play a central role in the rehabilitation of palatal-velar defects, restoring both function and aesthetics with the ultimate goal of improving the patient's quality of life (Sprintzen & Bardach, 1995).

2. Case Report

A 72-year-old completely edentulous patient underwent a velar resection for adenoid cystic carcinoma. She subsequently received transcutaneous external beam adjuvant radiotherapy with a total dose of 70 Gy.

Clinical examination revealed a symmetrical face with no visible scarring (Figure 1). The surgery had no impact on extraoral aesthetics. However, a moderate limitation in mouth opening was noted, attributed to partial post-radiation muscle fibrosis.



Figure 1. Exo-oral view.

Intraoral examination revealed a completely edentulous maxilla and mandible, with a loss of soft palate substance. The resection surgery resulted in a division of the soft palate, extending from the uvula to the posterior border of the hard palate.

The two remaining stumps of the soft palate had spread apart, forming a triangular slit with an anterior apex measuring 1 cm and a posterior base measuring 3 cm (**Figure 2**).



Figure 2. Endo-buccal view.

The mandibular arch was completely edentulous and exhibited no significant abnormalities.

Prosthetic management

Prosthetic management is initiated with the creation of a primary impression, which is then utilised to produce an individual impression tray. The optimal material for this stage is an irreversible hydrocolloid (alginate), whose light texture is well tolerated, particularly in patients with a history of tumour resection surgery.

It is important to note that alginate possesses the notable advantage of being able to spread easily and faithfully record recesses and retentive areas. It is recommended that an alginate with a firm consistency be used in order to reduce setting time. This can be achieved by slightly reducing the amount of water during mixing.

The impression is taken using a full denture tray, modified with a posterior wax extension. A compress is placed in the undercut areas to avoid the infiltration of the material into these areas.

In the mandible, the impression is taken in the conventional way (**Figure 3**).

Secondary impression

An individual impression tray with self-curing resin and a distal extension largely covering the loss of substance is made (**Figure 4**).

In the presence of a loss of velar substance, the adjustment of the individual impression tray must be particularly precise and rigorous. The limit follows the mucosal reflection line, which is typically situated 1 to 1.5 mm below the floor of the vestibule. However, in the paratubercular areas of Eisenring, the limit coincides with the floor of the vestibule.

The medial labial frenulum and lateral flanges should be approximately 2 mm clear.

The posterior extension is then adjusted accordingly. It is imperative that there is no contact between the lateral and posterior walls of the impression tray when the patient produces the sound “AHHHH”. Swallowing tests are then conducted by requesting that the patient ingest small sips of water, with the objective being for the water to pass through without causing discomfort.

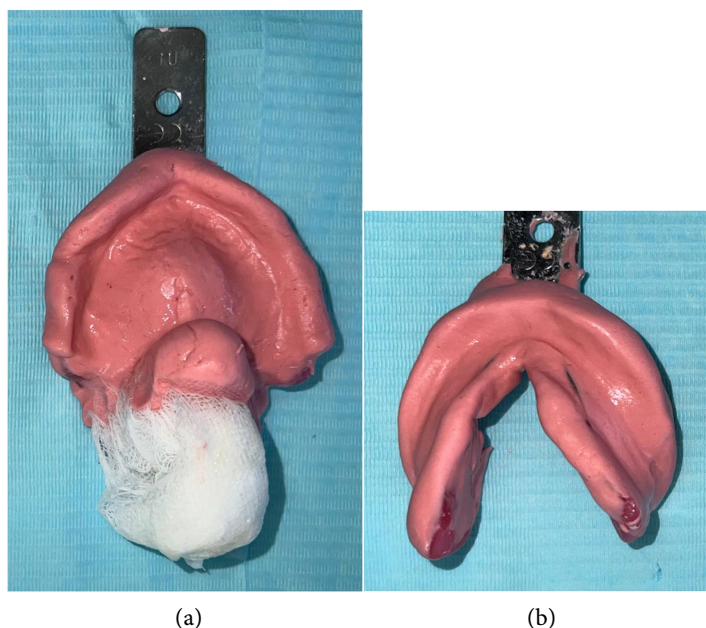


Figure 3. (a) Maxillary primary impression; (b) mandibular primary impression.



Figure 4. Individual impression tray.

The patient is also asked to perform head movements, including lateral and frontal flexions, which must be performed without difficulty. In order to ascertain the adequacy of the bucco-nasal airflow, a preliminary check of respiration is undertaken.

The utilisation of low viscosity silicone is advocated for the precise identification of areas of extension. Berry proposed that under-extension of the prosthesis was initially favoured over excessive extension, as this would allow for the development of compensatory function (Sprintzen & Bardach, 1995).

The initial impression is characterised by the process of remargining. The utilisation of Kerr paste is not advised in patients with a history of radiotherapy, due to its rigid texture and elevated melting temperature, which may result in lesions or burns.

In this particular context, the utilisation of polyether for remargining constitutes a noteworthy alternative (**Figure 5**).



Figure 5. Individual impression tray after adjustment and polyether remargining.

The final impression is made using polyether under digital pressure, and the patient is asked to make all the necessary muscular movements (**Figure 6**). It has been demonstrated that certain sounds directly involve the soft palate, causing it to rise and stretch. In particular, this is the case for sounds such as [K] and [G]. The production of nasal sounds, such as [M] and [N], has been shown to result in the closure of the soft palate.

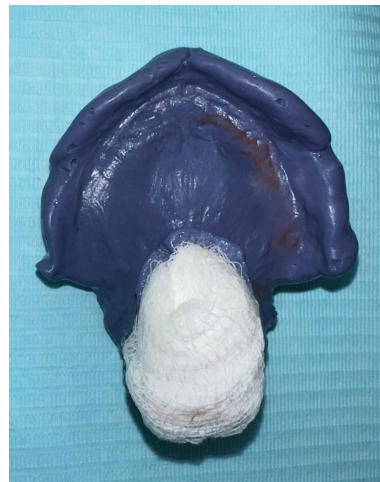


Figure 6. Secondary impression.

Finally, the production of sustained sounds such as “AHHHH” facilitates the evaluation of velar mobility and function.

It is imperative to ensure that the undercut areas are filled to prevent the infiltration of material into the recesses of the loss of substance.

The occlusal parameters, which included the establishment of the occlusal plane, the determination of the vertical occlusal dimension, and the recording of the centric relation, were carried out using conventional methods.

Velar functional impression with delayed-setting resin (Soft liner®).

Following the delivery of the final prosthesis, occlusal balancing is performed. In order to perfect the adaptation of the prosthesis, a new functional impression is taken using a delayed setting resin (**Figure 7**).



Figure 7. Functional impression with delayed-setting resin.

The patient then wears the prosthesis for a period of seven days, during which time they continue to perform their usual physiological functions (such as chewing and phonation). A subsequent session is then scheduled to evaluate the obturator adaptation.

During this session, the patient is asked to drink water and read a text, in order to assess the tightness of the prosthesis. In the event of functional complaints pertaining to the seal, a new relining is conducted.

Once the patient has been functionally satisfied with the result, the prosthetic base is then repaired in the laboratory. The subsequent phase involves the execution of the final occlusal adjustment, followed by comprehensive occlusal balancing procedures and thorough medical examinations (**Figure 8**).



Figure 8. Definitive maxillary prosthesis.

In subsequent follow-up sessions, the patient conveyed satisfaction with both the functionality and the aesthetic outcomes of the procedure (**Figure 9**)



Figure 9. (a) Endo-buccal view; (b) before the dentures were placed; (c) after the dentures were placed.

3. Discussion

The rehabilitation of velopharyngeal defects poses a significant challenge within the domains of maxillofacial surgery and prosthetics. The evolution of surgical methodologies and interventions, particularly the utilisation of microvascular flaps for reconstruction, has resulted in a substantial enhancement in the quality of life of patients afflicted with maxillary defects of congenital or acquired origin. However, it has been demonstrated that surgical reconstruction of the soft palate does not always permit satisfactory results to be obtained with hermetic obturation of loss of substance.

In patients who have undergone tumour resection, prosthetic rehabilitation is often preferable to surgical reconstruction, as it facilitates easier inspection of the defect for the possibility of recurrence. Furthermore, it is important to note that certain patients may possess either oral or systemic factors that contraindicate surgical intervention (Kreef, 2012).

Maxillofacial prosthetics can be defined as the art and science of artificial facial reconstruction. A distinction is made between extra-oral prostheses, also known as facial epitheses, and endo-oral prostheses, which rehabilitate maxillo-mandibular loss of substance.

The procedure is indicated in cases of loss of substance following trauma, infectious pathology or tumour resection (*The Glossary of Prosthodontic Terms*, 2005).

The prosthetic treatment of velar defects is a procedure that is known to be particularly complex. In order to facilitate the restoration of velopharyngeal competence in patients, it is imperative that the treatment in question fulfills both anatomical and functional requirements. The effective retention of conventional prostheses in patients suffering from total edentulism and soft palate defects remains a particularly delicate task. This difficulty is primarily attributable to the mobile nature of the soft palate and the paucity of prosthetic support surfaces (Harrison, 1992).

It is important to note that there are differences between obturator prostheses designed for patients with congenital soft palate defects and those designed for patients with acquired defects (Abreu et al., 2007; Shifman et al., 2000).

In the presence of surgically-induced velopharyngeal dysfunction, the design of the obturator prosthesis varies according to the extent and location of the loss of substance. The obturator is responsible for the re-establishment of velopharyngeal closure, the control of nasal emission during speech, and the provision of a seal by preventing the leakage of food and liquids (Curtis & Beumer, 1996; Saunders & Oliver, 1993; Yoshida et al., 1993).

Indeed, mastery of the impression technique is of paramount importance for accurate registration of the supporting surface. Anatomical features favourable to prosthetic retention, in particular the undercuts in the area of velar defect, the tuberosities and the ridges, must be used carefully and judiciously.

It is also recommended that speech therapy be included in the treatment protocol to improve the patient's speech. Speech therapy helps to retrain phonation mechanisms and promotes better velopharyngeal coordination, thereby contributing to more intelligible speech and reducing unwanted nasal emissions (Azhari et al., 2017).

In our case, the patient did not have a palatal defect, which provided a sufficient prosthetic support surface to ensure good stability and optimal retention of the prosthesis.

The main challenge was to obtain an accurate dynamic impression of the remaining velar stumps while ensuring an effective seal and respecting the pharyngeal walls.

Two types of secondary impressions were taken: the first using a polyether material with functional movements to mobilise the anatomical structures, and the second, known as the ambulatory impression, using a slow-setting resin to refine the impressions.

This approach produced satisfactory esthetic and functional results, contributing to a significant improvement in the patient's quality of life.

4. Conclusion

The prosthetic rehabilitation of velar defect, especially after surgical resection, constitutes a real clinical challenge that requires a rigorous and individualised approach.

The success of the treatment depends on a precise analysis of the defect, the development of a personalised protocol, the use of an impression technique adapted to the residual structures, and close collaboration between several specialists, including the maxillofacial surgery team, the oncologist, the speech therapist and the psychologist, in order to optimise both functional and aesthetic results.

In this way, the maxillofacial prosthesis, combined with functional rehabilitation, not only helps restore vital functions but also significantly improves the patient's quality of life.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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