

## CASE REPORT

# Prosthetic Rehabilitation of Velopharyngeal Incompetence

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## ABSTRACT

Velopharyngeal (VP) dysfunction takes place when palatopharyngeal valve is unable to perform its own closing due to a lack of tissue or lack of proper movement. Insufficiency induces nasal regurgitation of liquids, hypernasal speech, nasal escape, disarticulations, and impaired speech intelligibility. Treatment options include surgical correction, prosthetic rehabilitation, and speech therapy, though optimal results often require a multidisciplinary approach. This case report describes a novel approach for rehabilitation of a patient with soft palate defect (VP incompetence).

**Keywords:** Cleft palate, Obturator, Palatal lift prosthesis, Palatopharyngeal, Velopharyngeal.

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## INTRODUCTION

The soft palate acts as a dynamic separator between oral and nasal cavity.<sup>1</sup> The soft palate, lateral, and posterior pharyngeal walls form the velopharyngeal (VP) closure so that all of them create a three-dimensional muscular valve which is known as VP sphincter.<sup>2</sup> The VP closure pattern depends on the contraction degree of the sphincter components. Adequate VP closure is required during swallowing and production of all consonants except for the nasal ones.<sup>3</sup>

Impairment of VP function can be due to insufficiency or incompetency.<sup>3-8</sup> Velopharyngeal insufficiency is distinguished by speech and nasal resonance abnormalities related to defects of the soft palate, which may be congenital as in cleft lip and palate or acquired as in palatal tumor resection.<sup>5-7</sup> Velopharyngeal incompetence describes dysfunction of an anatomically intact VP mechanism as in patients with neuromuscular disorders.<sup>3,4,8</sup>

Beumer et al<sup>9</sup> described that the reconstructive surgery of acquired soft palatal defects is not indicated because of excessive tissue loss and the need to monitor the tumor site for recurrent disease. Also, surgical reconstruction of these defects can result in a deficient, nonfunctioning palatopharyngeal mechanism; when surgical treatment is not considered as an option, prosthetic management of VP insufficiency is carried out by means of a pharyngeal obturator, whereas VP incompetence is traditionally managed by a palatal lift prosthesis.<sup>4,5,7,8</sup>

Characteristic VP closure above the palatal level with anterior-posterior elevation of the soft palate is displayed by normal adults. The extent of closure of the soft palate with the posterior pharyngeal wall varies with head position. Pattern of soft palate movement varies between men and women. Soft palate in men is longer, elevation is greater, amount of contact with the posterior pharyngeal wall is less, and inferior point of contact with the posterior pharyngeal wall is higher.<sup>9</sup>

A pharyngeal obturator is a removable maxillary prosthesis that has a posterior extension to separate oropharynx and nasopharynx.<sup>5,9</sup> This obturator prosthesis restores the defects of the soft palate and allows adequate closure of palatopharyngeal sphincter.<sup>5,7</sup> When a pharyngeal obturator is placed, the patient can exhibit adequate separation between the oral and nasal cavities during production of plosive consonants or while blowing with variable intensity.<sup>10,11</sup> An effective prosthesis will restore speech, allow proper swallowing, and have an acceptable appearance.<sup>12</sup> However, it should have sufficient retention and stability.

This clinical report describes a novel approach for prosthetic rehabilitation of an edentulous patient with VP incompetence.

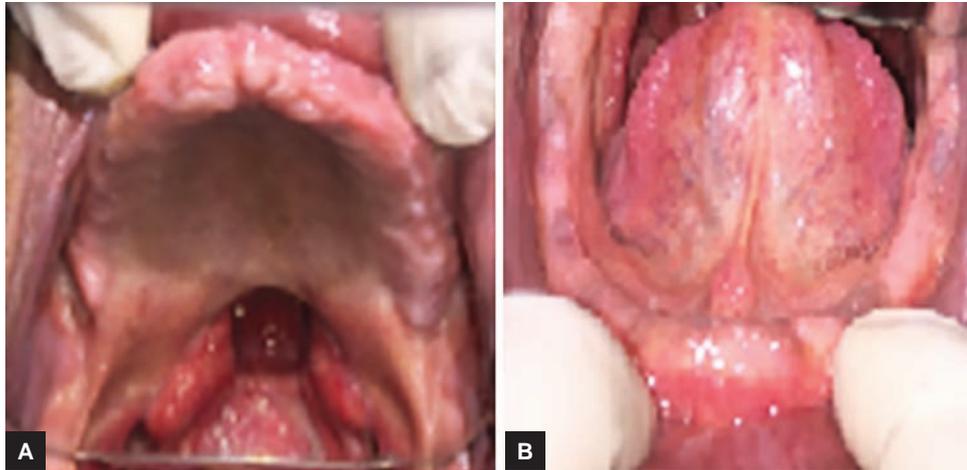
## CASE REPORT

A male patient aged 58 years reported to the Department of Prosthodontics, Manav Rachna Dental College, Faridabad, India, with the chief complaint of missing teeth in upper and lower arch since 5 years. Detailed case history was recorded. Teeth were extracted as they were mobile and decayed. Patient had no significant past medical history and did not have history of previous denture wearing. Intraoral examination revealed completely edentulous upper and lower arches, cleft of soft palate (Veau's

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**Figs 1A and B:** Intraoral view



**Figs 2A and B:** Modified edentulous perforated tray



**Fig. 3:** Maxillary alginate impression involving the defect

classification<sup>9</sup> – group I) with VP incompetence (Fig. 1). Speech difficulty, nasal regurgitation, and hypernasality were observed.

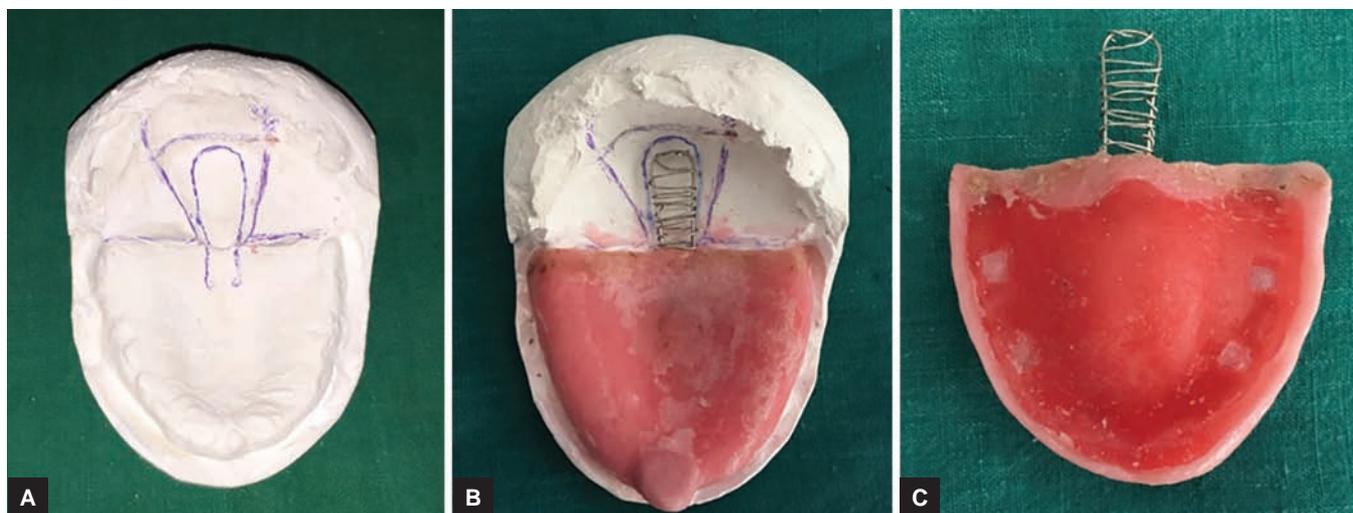
Surgical treatment option was eliminated considering age, systemic health, and economic status of the patient. Prosthodontic treatment decided was complete denture with hollow pharyngeal bulb prosthesis.

Technique followed was in accordance with that of Beumer et al<sup>9</sup> with some changes which included modification of the stock tray for making primary impressions, use of polyvinyl siloxane instead of low fusing impression compound for making final impression, and making the bulb of the prosthesis hollow with the help of addition silicone (putty consistency).

Upper and lower perforated stock trays were selected. Upper tray was modified with orthodontic wire, and wax extension was made into the defect to record the defect (Fig. 2). Then upper and lower preliminary impressions were made with irreversible hydrocolloid. The upper impression also recorded the defect (Fig. 3). Impressions were poured with dental stone to make diagnostic casts.

Next step is the fabrication of special tray for border molding. Lower special tray is fabricated in a conventional manner using autopolymerizing acrylic resin. But during the fabrication of upper tray following factors were kept in mind<sup>13</sup>: There should be a 5 mm gap between the bulb and posterior pharyngeal wall. Angle of the bulb should be approximately 20° relative to the palatal plane. McKerns and Bzoch<sup>14</sup> showed that in men the typical relation of the soft palate to the posterior pharyngeal wall is at a point above the palatal plane. For women contact is found to occur at or below the palatal plane.

Keeping in mind all these criteria, upper special tray was fabricated with autopolymerizing acrylic resin having pharyngeal extension (Fig. 4). Border molding was accomplished by recording all the functional movements of the soft palate, by asking the patient to perform side to side movement, bend head in front and back direction following a circular path. Following this, the patient was asked to swallow. This helped to record the anterior and posterior tonsillar pillars, tori tubari, Passavant's ridge, and the anterior tubercle of the atlas.



**Figs 4A to C:** Primary cast with special tray



**Figs 5A and B:** Maxillary wax-up and putty index

Impression of the defect area was made with low-fusing impression compound (Green stick). Lower border molding was done in conventional manner. Upper final impression was made with medium body polyvinyl siloxane and lower with ZnOE. Beading and boxing was done and impressions were poured with dental stone to fabricate master casts. Autopolymerizing acrylic resin record bases were made. In case of upper record base, it did not include the pharyngeal extension. Occlusal rims were made. Jaw relations and try-in was done in accordance with conventional complete denture fabrication procedures. After try-in was over, all the undercuts of the defect area were blocked with wax. Flasking and dewaxing was done. During packing in order to make the bulb hollow, additional silicone in putty consistency was mixed and placed in between two layers of heat-cure acrylic resin in the defect region (Fig. 5). After dentures were processed, they were finished and polished. Two holes were made, one in the posterior wall and other



**Fig. 6:** Putty removed from the holes

in lateral wall and whole of the putty was scooped out. Holes were then covered with autopolymerizing acrylic resin (Figs 6 and 7).



Fig. 7: Finished and polished hollow palatal lift prosthesis



Fig. 8: Finished and polished maxillary and mandibular denture



Figs 9A to D: Denture insertion

Hollow VP speech bulb obturator along with mandibular complete denture was delivered and postinsertion instruction was given (Figs 8 and 9). Perceptual rating of speech on Temple Street Scale revealed improvement in speech with reduction in hypernasality and hyponasality. Also, improvement in swallowing was observed with considerable reduction in nasal regurgitation. Further improvement was expected, so patient was referred to speech therapist for speech therapy.

**DISCUSSION**

Prosthetic rehabilitation of the patients suffering from VP deficits with obturator prostheses varies according to the location and nature of the defect or deficiency.<sup>4,5,7,8</sup> However,

the objectives of obturation are to provide the capability for the control of nasal emission and inappropriate nasal resonance during speech and to prevent the leakage of material into the nasal passage during deglutition.<sup>5,9,15</sup>

To achieve normal speech with a prosthesis, an accurate prognosis is extremely important for the patients exhibiting considerable movement of the residual VP complex during function.<sup>2,15</sup> Because the movement of the lateral pharyngeal walls is essential for the control of nasal emission, little or no movement of VP mechanism makes it difficult to achieve normal speech with either surgical reconstruction or prosthetic therapy.<sup>2,4,11,15</sup>

In the literature, several types of prostheses have been described to improve speech ability.<sup>4,5,7,15-17</sup> A pharyngeal

obturator prostheses may prevent the hypernasality and/or nasal emission associated with VP inadequacies.<sup>4,5</sup> In order to obtain adequate VP closure during speech and swallowing, a posterior extension is added to prosthesis.<sup>5,10</sup>

Prosthetic treatment with palatal lift prosthesis was first reported by Gibbons and Bloomer.<sup>18</sup> This type of prosthesis is especially useful for patients with VP incompetence. The objective is to displace the soft palate to the level of normal palatal elevation, thus enabling closure by pharyngeal wall action. It has certain advantages,<sup>18</sup> such as the gag response is minimized due to the superior position and the sustained pressure of the lift portion of the prosthesis against the soft palate. The physiology of the tongue is not compromised due to the superior position of the palatal extension. The access to the nasopharynx for the obturator (if necessary) is facilitated. The lift portion may be developed sequentially, to aid patient adaptation to the prosthesis. However, it is contraindicated<sup>18</sup> if adequate retention is not available for basic prosthesis, if the palate is not displaceable, or if the patient is uncooperative.

The impression should be examined for contact with the pharynx bilaterally and posteriorly.<sup>10</sup> In this report, patients were allowed to drink water to test the complete closure of the anatomical defect of soft and hard palate. The water should not reflux into the nasal cavity when the patient is in upright position.<sup>9</sup> The success of the soft palate defect prosthesis depends on the functional adaptation of the impression material.<sup>7,9,10</sup> In the current case, low-fusing green stick compound was used in functional contouring of the palatal defect and VP portion. Light body addition silicon impression material was added to make the final impression.

Retention of pharyngeal obturator can be obtained by direct and indirect retainers for patients with complete maxillary dentition; however, in edentulous patients, achieving an effective retention by conventional prostheses for the edentulous patients with defects becomes very difficult, so an attempt was made to make the bulb of the lift prosthesis hollow by using addition silicone in putty consistency which was later removed. It made the prosthesis very light, thus increasing its retention and stability.<sup>19,20</sup>

The evaluation of clinical efficacy of the appliance by an experienced speech pathologist is essential and should include assessing the resonance and nasal emission, assessment of articulation and intelligibility, and reduction in existing compensatory mechanisms like glottal stops, pharyngeal fricatives, and facial grimace. There are various methods<sup>21</sup> to check the effectiveness of the appliance, which include perceptual speech examination, indirect assessments (cul-de-sac, see-scape, cold mirror test, tongue anchor technique), direct assessments (lateral cephalograms, nasoendoscopy, videofluoroscopy, and nasopharyngoscopy). Dwyer<sup>22</sup> concluded in his study

that Temple Street Scale had demonstrated best correlation with nasometric analysis and was easiest to perform when compared with other available speech examination scale. So in the present case, perceptual speech examination of hypernasality and hyponasality was performed using the Temple Street Scale. Score of the patient on the scale showed an improvement from 4 to 1, i.e., hypernasality reduced from moderate/severe on all vowels, some consonants to mild/moderate unacceptable distortion evident on close vowels; hyponasality reduced from severe-total denasal production of nasal consonants to mild/evident but acceptable. Also, further improvement was expected so patient was referred to speech therapist. Improvement in swallowing and reduction in nasal regurgitation was also observed with the use of prosthesis.

## CONCLUSION

Velopharyngeal insufficiency may take place when the VP valve is unable to perform its own closing, due to a lack of tissue or lack of proper movement. Treatment options include surgical correction, prosthetic rehabilitation, and speech therapy, though optimal results often require a multidisciplinary approach for the restoration of both anatomical and physiological defect. The patient was treated with a combination of speech therapy and VP prosthesis. Velopharyngeal insufficiencies, such as nasal regurgitation of liquids, hypernasal speech, nasal escape, disarticulations, and impaired speech intelligibility, considerably decreased with the prosthesis.

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