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## Review Article

### PROSTHETIC MANAGEMENT OF GLOSSECTOMY PATIENTS: A REVIEW

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#### ABSTRACT

The tongue is a movable muscular organ that are used for speech, sense of taste, swallowing, manipulation, positioning of food and for cleansing of the oral cavity. Prosthodontics play an important role in prosthetics rehabilitation of tongue for patients with extensive cancerous tongue involvement after glossectomy or with congenital missing tongue. When planning for prosthesis, considerations like support, stability and retention should be made into account. A broad search of published literature was performed using the keyword glossectomy, glossal prosthesis and tongue prosthesis from 1980 to 2017 in Medline, Google scholar, Google and only the most relevant topics were selected. This review article discusses the prosthesis management for glossectomy patients and selection of the same for various clinical conditions.

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#### INTRODUCTION

Tongue is the only movable muscular organ without any bone in the human body (Gunjan Gupta, 2014). It has very important role in perception of taste and sensations. For the patients with extensive cancerous involvement of tongue, glossectomy may offer the only treatment of choice. Surgery for carcinoma of tongue and floor of mouth results in alteration of the muscles of the tongue and floor of mouth. Both primary and secondary surgical procedure often results in scar formation with reduced mobility of the tongue during speech and deglutition. (Aramany MA, 1982) Speech and deglutition are usually impaired (GurmitKaur Bachher, 2010). Prosthodontists can be of invaluable importance in management of such patients (Gunjan Gupta, 2014). The viability of a prosthodontics approach to treatment depends on the type and extend of the surgery. The prosthodontics management of patients with partial tongue resection often includes lowering the palatal vault while the management of total glossectomy usually requires a mandibular tongue prosthesis (Cotert HS, 1999). Speech therapy can be used to help determine the proper placement of the portion of the prosthesis involved in speech. The prosthesis rehabilitation approach lowers the palatal vault with the false palate to enable the tongue to function against it during speech and swallowing.

#### Glossectomy

Oral Cancer may be treated with radiation or surgery (Beumer, 1996). Glossectomy is the surgical removal of the tongue. Partial glossectomy is the removal of any part of the tongue, from a small part of the side or tip, an entire half of the tongue or even more. Total glossectomy is the removal of the entire tongue, including the base of the tongue. Prosthetic rehabilitation can be proposed to enhance oral functions and appearance and psychological adjustment. In a total glossectomy a mandibular tongue prosthesis is the treatment of choice (Pravin bhirangi, 2012). Mandibular tongue prosthesis occupies in the space in the floor of the oral cavity. It provides with a platform for directing food into the oesophagus and aids in speaking. It can achieved the protection of the underlying fragile tissue and improvement.

#### Materials Used For Tongue Prosthesis

**Acrylic Resin:** PMMA resin is the material of choice. It has many advantages like, intrinsic and extrinsic colouration can be done easily with acrylic resin. Strength of this is material is high compared to silicone. (Muthukumar, 2016)  
Silicone

**RTV -silicone (Silastic 382, Silastic 399):** They set by condensation polymerisation in which stannous octate is the catalyst; Ortho-alkyl Silicate is cross linking agent. The advantages are, allows intrinsic colouration, easy handling,

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quick processing, good thermal and colour stability and inert. The disadvantages are they have weak edge strength, zipper effect, poor tear strength, high specific gravity, stiff, poor wet ability.

**Silicone (MDX 4-4210):** Most commonly used material for maxillofacial prosthesis. The material used to fabricate tongue prosthesis is silicone which has several advantages. (i) single component, (ii) ready to use, (iii) eliminating mixing errors, (iv) easy processing, (v) can be polymerized simultaneously with acrylic, (vi) stands the influences of oral environment without deterioration, (vii) non-irritant (viii) odourless and tasteless

#### **Various Clinical Scenarios**

##### **Completely edentulous with total glossectomy**

Treatment: Mandibular denture extending over the floor of the mouth with a mushroom shaped button attached to it on which silicon tongue can be placed. After a total glossectomy the floor of the mouth becomes concave. Impressions are made with irreversible hydrocolloid material using a maxillary tray for mandibular arch to record the floor of the mouth. The mandibular base extends over the floor of the mouth. A “mushroom like” button is made on the mandibular prosthesis so that a silicone tongue can be placed over it. Two prosthetic tongues can be made, one for speech and one for swallowing. The tongue made for speech is somewhat flat, with a slightly wide anterior elevation to aid in articulation of linguoalveolar sounds ‘t’ and ‘d’ and to aid in shaping the oral cavity for improved vowel production. The tongue for swallowing is made with a trough in the posterior aspect to guide the food bolus into the oropharynx (Gupta G, 2014).

##### **Completely edentulous with total glossectomy and hemimandibulectomy**

**Treatment 1:** Mandible is reconstructed with bone graft and implants are placed. After that implant retained overdenture is made with tongue prosthesis (Beumer J III, 1996).

**Treatment 2:** Mandibular complete denture obturating the defect and maxillary complete denture with a guiding flange. Loss of continuity of the mandible affects the balance of the lower face and leads to deviation of the residual segment toward the resected side.

In general, patients suffering extensive soft tissue loss resulting from tight wound closure, radiation therapy, and those requiring a classical radical neck dissection exhibit the most severe mandibular deviation and dysfunction. Esthetics is affected due to tissue contraction. Therefore to limit the deviation of mandible towards the resected side, a guiding flange is made. This is a treatment of choice in patients who are either not medically sound or cannot afford the expensive and extensive grafting procedures.

##### **Partially edentulous with partial glossectomy involving anterior part of tongue**

**Treatment:** Maxillary cast partial denture with palatal augmentation (Penn M, 2007).

##### **Condition: Dentulous patient with segmental resection of mandible and resection of lateral part of tongue.**

Treatment: Mandibular cast partial denture obturating the defect with a guiding flange and maxillary cast partial denture with palatal augmentation. The guidance flange for the mandibular framework was designed to extend on the nondefect side the tongue base with regard to both treatment choices and swallow outcomes after resection (Moni, A K, 2007).

##### **Types of tongue prosthesis based upon the function**

###### **Single piece tongue**

1. Tongue prosthesis for swallowing.
2. Tongue prosthesis for speech.

In edentulous patients, tongue prosthesis can be retained to either a mandibular or maxillary denture. Common problems associated with tongue prosthesis include lack of salivary control and loss of ability to maneuver food from the buccal vestibule. Therefore, it is best to fabricate two prosthetic tongues, one for swallowing and 1 for speech (Pravin B, 2012). A typical prosthetic tongue for speech is flat with wide anterior elevation, which aids in articulation of linguo-alveolar sounds. It also has a posterior elevation, which aids in production of posterior linguoalveolar sounds and helps to shape the oral cavity for improved vowel productions. The tongue prosthesis made for swallowing had a trough in its posterior slope to guide the food bolus into the oropharynx. A speech pathologist and a dietitian should monitor the patients who have had a glossectomy.

###### **Two piece tongue**

Impressions are made with alginate using a maxillary tray for mandibular arch in order to record the floor of the mouth properly. The base of the mandibular denture extends over the floor of the mouth. A “mushroom like” button is made on the mandibular prosthesis so that a silicone tongue can be placed over it. [Gupta, 2014]

###### **Prosthesis Attached to Maxillary Denture-Palatal Augmentation Prosthesis**

The Palatal Augmentation Prosthesis (PAP) has been defined by the Glossary of Prosthodontic Terms as a palatal prosthesis that allows reshaping of the hard palate to improve tongue/palate contact during speech and swallowing because of impaired tongue mobility as a result of surgery, trauma, or neurologic/motor deficits (GPT). The palatal augmentation prosthesis is used to restore impaired speech and swallowing in glossectomy patients by artificially lowering the palatal vault to provide contact between the remaining tongue and the palatal contours. (Sheikh Mohammad Alif., 2013) (Kharade, Pankaj, 2015) (Shimodaira K, 1998)

The function of the residual tongue is recorded with softened modeling compound. The patient is asked to repeat the linguo-velar sounds and the linguo-alveolar. The compound gets moulded accordingly and then the denture is processed. Modification if acceptable speech articulation is attained for most elements of speech except the linguo-alveolar fricatives ‘s’ and ‘t’, for which another modification can be done. A narrow, sharp groove carved in the midline of the palatal

prosthesis can, by directing the air stream, improve the production of these sounds (Sxahin N , 2005)

**Postoperative care:** Patients usually remain in the hospital for 7 to 10 days after a glossectomy. They often require oxygen in the first 24-48 hours after the operation. Oxygen is administered through a face mask or through two small tubes placed in the nostrils. The patient is given fluids through a tube that goes from the nose to the stomach until he or she can tolerate taking food by mouth. Radiation treatment is often scheduled after the surgery to destroy any remaining cancer cells. As patients regain the ability to eat and swallow, they also begin speech therapy.

**Risks associated with a glossectomy:** It includes bleeding from the tongue, poor speech and difficulty swallowing, Fistula formation, incomplete healing, Flap failure. Patients who have had radiotherapy are at greater risk of developing a fistula: This complication is often due to problems with the flap's blood supply.

**Factors governing the success of the tongue or palatal augmentation prosthesis:** It includes the presence or absence of teeth and the type of procedure that is combined with the glossectomy (eg, mandibulectomy, palatotomy, radiation therapy).

#### **Prosthetic and Speech Rehabilitation**

In the absence of the tongue and hypoglossal nerve, the laryngeal elevation is altered, thus resulting in changes of acoustic parameters. The tongue and palatal augmentation prosthesis again created changes in the vocal tract resulting to changes in the resonating system. Rehabilitation with tongue prosthesis appeared to help the patient in developing compensatory strategies for effectively managing soft bolus. Because of the reduced elevation of the tongue, patients are unable to clean the solid materials from palatal vault (Knowles JC , 1984). A thorough knowledge of normal n speech articulation is necessary before considering the compensatory articulation used by glossectomy patients.(McKinstry R E 1985).

In glossectomy patients, because tongue movement is restricted, it is important to evaluate tongue mobility more precisely to assist rehabilitation. Using palatography, it is usually possible to evaluate which area of the palate the tongue makes contact with during articulation. Articulatory function after glossectomy has been evaluated by means of dynamic palatography. The dynamic palatograph is an electrical apparatus that generates a visual display of constantly changing linguopalatal contact as a function of time, using an artificial palatal plate with affixed electrodes. Grimm DL evaluated on the effects of palate features and glossectomy surgery on /s/ production ,he found that for controls groups , hard palate height affected tongue height; a higher palate yielded a higher tongue. For patients, hard palate width affected tongue width; a narrower palate yielded a more anterior tongue. Tongue shape was unaffected by any palate features. Preference for /s/ showed an interaction effect between subject and palate height. Controls with high palates preferred a laminal /s/. All patients preferred a laminal /s/; glossectomy surgery may reduce tongue tip control.

## **DISCUSSION**

Resections of more than one third of the tongue base often lead to a permanent dysphagia. Swallow outcomes are related to the amount of tongue tissue that is removed Skelly *et al* have suggested that the totalglossectomy patients develop truly compensatory patterns of speech whereas partial glossectomy patients require prosthetic treatment and speech therapy to develop compensatory articulation. (Knowles JC, 1984) Mark Penn, (Mark Penn 2007) describes a clinical report of prosthetic management for feeding aid of a following total glossectomy and total laryngectomy. The prosthesis was designed as an implant retained overdenture with a lingual metal plate to facilitate food introduction into the oropharynx. The treatment improved mastication, appearance, and the quality of the patient's social life. Patients whose tongue or floor of the mouth has been resected usually undergo immediate reconstruction using local flaps, skin grafts, distant flaps or microvascular free tissue transfer. Although the shape of the tongue can be more or less rebuilt, its movement is restricted by defects of the body and the frenulum, the attachment of flaps, and residual tongue or postoperative scarring. Each of these restrictions results in dysfunctions of mastication, deglutition and speech Shimodaira's reports on the speech with palatal augmentation prosthesis (PAP) in total glossectomy without perceptual & acoustic analysis.(Shimodaira k,1980).The wide band spectrographs of "two" and "five", by Izdebski K, showed improved vowel formants and partial transitions in total glossectomy patient.(Izdebski K, 1987).Both palatal drop prosthesis and tongue prosthesis allowed the patient to increase the capacity to swallow and reduce the remaining Donders space. The speech appeared to be more intelligible but cannot fully restore.

FumiYoshioka (FumiYoshioka, 2004) measured the tongue pressure against the palate during articulating glossal sounds in normal subjects and glossectomy patients. He found that the three glossal sounds, [ti], [tʃi], and [ʃi], that require linguopalatal contact which have tendency of mishearing in glossectomy patients. Xinhui Zhou ( Xinhui Zhou,2011) analyses the speech acoustics between normal subjects and partial glossectomy patients with T1 or T2 tumors .There differences in fricatives the normal subjects and the glossectomy patients and these can be explained by the more posterior constriction in patients due to the glossectomy. Aimaijiang found that mixing ability was found to be significantly low only in patients who underwent glossectomy. Perceived chewing ability and objective mixing ability were significantly associated in the marginal mandibulectomy and glossectomy groups but not in the segmental mandibulectomy group. (Aimaijiang, 2015).

Tongue is the major articulator during the production of all phonemes except bilabial, labio-dentals and glottal sounds. Tongue movements modify the shape of the oral cavity and change the resonance characteristics that produce different consonants. (Aramany MA, 1982).The coordination of the muscle and nerve is impaired in glossectomy patients even after reconstruction by flap. Surgery for carcinoma of tongue and floor of mouth results in alteration of the muscles of the tongue and floor of mouth. Both primary and secondary surgical procedure often results in scar formation with reduced mobility of the tongue during speech and

deglutition(Aramany MA ,1982). The prosthodontics management of patients with partial tongue resection often includes lowering the palatal vault while the management of total glossectomy usually requires a mandibular tongue prosthesis (Cotert HS,1999). Speech therapy can be used to help determine the proper placement of the portion of the prosthesis involved in speech. The prosthesis rehabilitation approach lowers the palatal vault with the false palate to enable the tongue to function against it during speech and swallowing.

## CONCLUSION

Patient who has undergone total or partial glossectomy, rehabilitation of speech in the most important factor in re-establishing interpersonal communication. Rehabilitation with the tongue prosthesis appeared to help the patients in development of compensatory strategies for effective managing soft foods. Rehabilitation of swallowing also plays an important role in socialization. Speech therapy if undertaken proves a great help to these patients. The prosthetic tongue may not replace entirely the functions of tongue but it does provide glossectomy patient with a certain degree of comfort and function. Patients with partial glossectomy suffer minimal functional impairment and require no prosthetic intervention. Removal of more than 50% of the tongue requires construction of a palatal or lingual augmentation prosthesis. Total glossectomy causes a large oral cavity, loss of verbal communication, and pooling of saliva and liquid. Patients with a total glossectomy require a total tongue prosthesis. In edentulous patients, such a prosthesis can be attached to the mandibular teeth through a lower partial denture. In edentulous patients, tongue prosthesis can be retained to either a mandibular or maxillary denture. Common problems associated with tongue prosthesis include lack of salivary control and loss of ability to maneuver food from the buccal vestibule. Therefore, it is best to fabricate 2 prosthetic tongues, 1 for swallowing and 1 for speech. The tongue prosthesis for swallowing is made with a trough in its posterior slope to guide the food bolus into the oropharynx. A speech pathologist and, when necessary, a nutritionist should monitor all patients who have a glossectomy.

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