Salivary Reservoir in Maxillary Complete Denture- A Case Report

Abstract

In complete denture prosthesis, saliva plays an important role because it provides retention and comfort to the patient. In reduced saliva conditions, the oral mucous membranes may develop erythema and sore spots, and the patient may feel discomfort when dentures are in function. Hence, salivary substitutes are prescribed for symptomatic treatment. One efficient way to ensure slow and continuous release of salivary substitute is to incorporate a salivary reservoir in the denture. This will facilitate the lubrication of the oral environment, and aid in success of the prosthesis. This case report describes a method of fabricating salivary reservoir in maxillary complete denture in a patient suffering from radiation-induced xerostomia.

Introduction

Oral Squamous Cell Carcinoma is one of the most common malignancies in Southeast Asia, accounting for up to 30–40% of all malignancies in India. According to the latest GLOBOCAN Statistics, oral cancer is the 2nd most common cancer in India, being the most common among males and 4th most common among females in India[1]. The mode of treatment of OSCC depends on various factors such as stage of the disease, site of the disease, and overall health status of the patient. For stage 1 and stage 2 oral cancer patients, a single line therapy by radiotherapy or surgery is the preferred initial treatment. Surgery and/or radiation therapy is the treatment for the patients with advanced stage 3 and 4 cancer. Then systemic chemotherapy was introduced as a part of combined treatment[2]. Squamous cell carcinoma is usually radiosensitive and patients who receive radiotherapy to the fields involving the oral cavity experience various oral complications[3]. Mucositis, dysgeusia, radiation caries, soft tissue necrosis, progressive periodontal attachment loss, trismus, oral candidiasis, osteoradionecrosis, and xerostomia are some of radiotherapy's complications. **Xerostomia** is one such common complication after radiotherapy because salivary glands are highly sensitive to radiation. The changes in the salivary glands following radiotherapy include progressive fibrosis, loss of fine vasculature, and parenchymal degeneration. The degree of xerostomia is directly proportional to the radiation dose administered and the volume of salivary gland exposed to radiation. Standard head and neck radiotherapy results in serious, often irreversible damage to the major and minor salivary glands[4]. Radiation therapy also changes the composition of saliva, increasing its viscosity, reducing its buffering capacity, altering its concentration of electrolytes, and changing its nonimmune and immune antibacterial systems. There are several other causes of xerostomia includes diabetes, depression, alcoholism, pernicious anaemia, menopause, vitamin A or vitamin B complex deficiency, HIV infection, and autoimmune diseases such as Sjögren's syndrome. Aging as the sole cause of decreased salivary flow is unproven. The most common cause of xerostomia

is the use of drugs to manage chronic diseases. Xerostomia is a possible side effect associated with more than 400 drugs including antihypertensives, antidepressants, antihistamines, bronchodilators, antiparkinsonians, antispasmodics, anticholinergics, and sedatives. Mouthwashes, tobacco, and caffeine may alter salivary flow or cause dryness of the oral mucosa[5].

Xerostomia is defined as a subjective complaint of dry mouth that may result from a decrease in the production of saliva[6]. Xerostomia is neither an illness nor a diagnosis; it is a symptom. Oral dryness is a subjective sensation. The total volume of saliva secreted by humans is approximately 600 to 1000 ml daily. The resting flow rate of whole saliva is 0.2 to 0.4 ml/min. On stimulation the rates increase to 2 to 5 ml/min[7]. A diagnosis of hyposalivation is made when the stimulated salivary flow rate is ≤0.5–0.7 ml/min and the unstimulated salivary flow rate is ≤0.1 ml/min[8].

Xerostomia disrupts the normal homeostasis of the oral cavity, leading to changes in the taste, burning sensation, halitosis, difficulty in speech, difficulty in swallowing, and decreased dietary intake. These changes adversely affect the patient's overall health and quality of life. Furthermore, the lack of saliva as a thin layer between the oral mucosa and dentures reduces denture retention and increases inflammation and ulceration in the oral cavity. Hence, complete dentures are often poorly tolerated in patients with xerostomia[9].

There are several treatment options available to the clinician depending on the aetiology of xerostomia. Most cases require symptomatic treatment and include patient counselling, changes in dietary pattern, lifestyle modifications, salivary stimulants, and use of salivary substitute. A salivary reservoir denture is an effective solution in edentulous patients with xerostomia to deliver salivary substitute constantly into the patient’s mouth without affecting the normal routine[10]. This case report describes a simple and innovative technique for fabrication and designing of a maxillary salivary reservoir complete denture for a patient with xerostomia secondary to radiation therapy.

Case Report

A 63-year-old female patient reported to the Department of Prosthodontics at Dr R Ahmed Dental college and Hospital for the replacement of missing teeth. The patient also complained of difficulty in swallowing and mastication. History of Excisional biopsy in left maxillary posterior region 1 year 7months months back. Then patient underwent radiation therapy which was completed 1 year 3 months ago for focal keratinizing squamous cell carcinoma of left maxillary posterior region. Prior to the radiation therapy, she had undergone total extraction of all teeth. She had a history of diabetes under medication. Extraoral examination revealed that depressed upper lip in left side with scar formation in middle of the upper lip. Intraoral examination revealed that complete healed palatal mucosa. The patient was diagnosed as a case of radiation-induced xerostomia. A counselling process was also implemented which included dietary counselling, multivitamin supplements, and frequent drinking of water. It was decided to construct a salivary reservoir in maxillary complete denture containing salivary substitute to relieve xerostomia and aid the patient in the daily activities.

Procedure

1. Steps in fabrication of conventional complete denture are similar up to the try-in stage (Fig.1).
2. The reservoir walls and lid rim are built with sprue wax (3 mm Schuler Dental, Germany) (Fig.2). A slight undercut must be created on the inner aspect and a groove is made on the external surface of the lid rim using a Le Cron carver. These two features facilitate attachment for the flexible lid of the reservoir. The reservoir volume must be assessed at this stage by injecting a known quantity of liquid using a calibrated syringe.
3. The trial denture is waxed up, invested, and processed in the conventional manner.
4. The denture is finished and polished and then duplicated using alginate to obtain a second working cast made of Type III Dental Stone (BN Plast, BN chemicals, Kolkata). The reservoir space must be blocked out with the help of plaster, while the undercut on the inner aspect of the reservoir lid rim must be relieved before fabricating the reservoir lid (Fig.3).
5. The reservoir lid is fabricated with a 2-mm flexible thermoplastic sheet (BIOPLAST) on the second working cast of the denture (Fig. 4).
6. A 0.8-mm release hole is made on the most dependent portion using a straight fissure bur. This permits the slow and continuous release of the salivary substitute.
7. The reservoir lid is snapped to close the reservoir and is filled with salivary substitute (methyl cellulose– wet mouth, ICPA) using a calibrated syringe through the release hole. The salivary substitute is released when the tongue creates pressure in the anterior portion of the palate (Fig.5).
8. The maxillary salivary reservoir complete denture is ready to be inserted (Fig.6).

Fig. 1

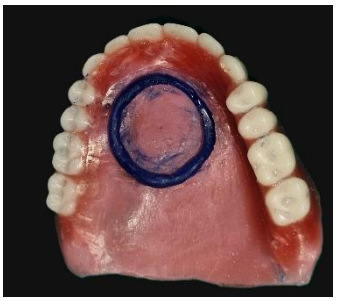

Fig. 2

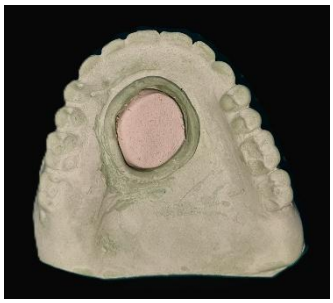

Fig. 3

Fig. 4 Fig. 5 Fig. 6

Instructions to the Patient

1. Postinsertion instructions were given to the patient regarding oral and denture care.
2. The patient was instructed about the cleaning of the reservoir and the lid using soft bristled toothbrush and toothpaste.
3. The patient was instructed about refilling the reservoir with salivary substitute with due care.
4. The patient was asked to make a conscious effort to consume at least eight glasses of water, lemon juice, or milk.
5. Postinsertion check-up was scheduled on the next day and regular recall visits were planned every month.

After a 3-month follow-up, the treatment was found to be satisfactory as the patient has found a great reduction in the symptoms of xerostomia and found it easy to use and clean the denture.

Discussion

Radiation therapy is often administered to individuals undergoing treatment for oral cancer. The prevalence of post radiation xerostomia is reported to be 90%[11]. Xerostomia creates an unhealthy oral environment and can also cause or exacerbate a painful oral condition. The dentist needs to acknowledge the seriousness of these issues and keep working to resolve them. There are various treatment methods available, depending on the cause of xerostomia. However, a combination of methods is often employed to make prosthesis successful. The aim of xerostomia treatment is to lessen the patient's discomfort and enable them to comfortably wear their denture and carry out their regular oral activities.

Complete dentures are poorly tolerated by patients with reduced salivary flow because of the lack of saliva bonding between the interface of the prosthesis and the oral/gingival tissues[12]. With a gradual, continuous, and prolonged release of salivary substitute is provided by the reservoir denture, provides clinicians with an alternate approach to treating patients with xerostomia[13]. Artificial salivary substitutes fall into two categories: those based on mucin and those based on carboxymethyl cellulose. Commercially available saliva substitutes containing carboxymethyl cellulose are the most commonly used as they are less costly and readily available. Wet Mouth, Saliveze, Salivart, Moi-Stir, and Salix are a few of the artificial salivary substitutes that are on the market.

Several authors have recommended many approaches to fabricate reservoir dentures with available space in either the maxillary denture or the mandibular denture.

Mendoza and Tomlinson[14] described split-denture technique for artificial saliva reservoir in the mandibular denture, which was split into upper and lower parts. The laboratory stages were time-consuming in this technique. Similar methods were used by **Dabas et al**[15]. and **Hallikerimath and Jain**[16].

Burhanpurwala et al[17]**.** described a method for fabricating mandibular reservoir denture, but still the laboratory steps were complicated. **Sinclair et al**[18]**.** used cobalt samarium magnets to connect the lower and upper part of the mandibular reservoir denture. Although he succeeded in providing a reservoir with a maximum capacity, the procedure required exhaustive laboratory steps. He has outlined a criterion for fabrication of salivary reservoir denture which includes maximum space for the reservoir, minimum adjustments in the finished denture so that a maximally extended reservoir would not be perforated and provide easy cleaning and refilling the reservoir. The methods advocated for incorporating reservoir space in mandibular complete denture are costly, time consuming, and require exhaustive laboratory steps.

Toljanic and Zucuskie[19] described the use of salivary reservoir in the maxillary denture in patients with xerostomia. Its advantages over a reservoir in the mandibular denture includes larger reservoir size, provides flow of saliva to the whole mouth unlike mandibular reservoir where flow is restricted to the floor of the mouth, and do not block the outlet holes by fluid and food in the floor of the mouth. However, incorporating reservoir in the maxillary denture leads to increase in weight, which may affect its retention and stability. **Hirvikingas et al.**[20] used a Gerber attachment to operate the release mechanism for the salivary substitute in the maxillary reservoir complete denture. Disadvantage of this technique is that the precision attachment increased the cost of the treatment. **A. M. Joseph et al.**[21] described the use of salivary reservoir in the maxillary denture in patients with xerostomia.

The advantages and disadvantages of this technique in comparison with conventional methods of fabrication of salivary reservoir complete denture are outlined below.

Advantages

1. Simplified technique.
2. Cost-effective.
3. Laboratory procedures are less time-consuming.
4. No additional clinical steps.
5. Physiologic mechanism of salivary release.
6. Easy to use, clean, and refill the reservoir.
7. Sustained and slow release of salivary substitute.
8. Does not interfere with normal oral functions.
9. Easy visibility of salivary substitute in the chamber.
10. Easy accessibility to the reservoir by the dentist and patient.
11. Reservoir is less bulky compared to the conventional techniques.

Disadvantages

1. Additional laboratory steps.
2. The patient should manually refill the reservoir at regular intervals.
3. High degree of precision is mandatory to ensure accurate and smoothly fitting the reservoir lid.

The volume of reservoir by this technique was 3 mL for a working duration of 2 h. The highlight of this technique used here is that it allows fabrication of a prosthesis that makes swallowing a control mechanism for the flow of salivary substitute. As the patient swallows, the tongue contacts the anterior portion of the palate and hence the thermoplastic membrane. This creates positive pressure inside the reservoir thus pushing the salivary substitute out of the outlets. Then, the pressure is relieved, air is sucked in creating a negative pressure, and the next cycle starts. Although our technique has a definite advantage over other techniques, it cannot be used in cases with high palatal vaults. In case of repair or replacement of the lid, the patient or clinician can preserve the working cast which can be used readily for the lid fabrication.

Conclusion

This article reports a simple method for the construction of salivary reservoir in maxillary denture and an economic option for the management of xerostomia. Xerostomic patients wearing prosthesis can benefit immensely from this as it will enhance the oral health and quality of life of such patients. To meet patient's functional and esthetic demands, a thorough knowledge and understanding of different salivary reservoir designs, and the merits and demerits of each design are essential. The goal of future research should be directed toward developing more physiologic salivary substitutes. Periodic recall and review were carried out and observation was noted. Patients' motivation and co-operation played an important role in the success of the prosthesis.

Conflict of Interest

None.

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