

An Innovative Design of 2-Piece Saliva Reservoir Using Precision Attachment: A Case Report

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Abstract Standard head and neck radiotherapy results in serious, often irreversible damage to the major and minor salivary gland tissues. The resultant profound hypo-salivation leads to serious oral health and functional problems that seriously affect oral health-related quality of life. Intra-oral devices with reservoirs have been developed that allow the release of saliva substitute into the mouth. This case report describes an innovative technique for incorporation of saliva reservoir in cast partial denture in patient with post irradiation xerostomia.

Keywords Saliva reservoir · Precision attachment · Palatogram analysis

Introduction

Xerostomia (dry mouth) is defined as a subjective complaint of dry mouth that may result from a decrease in the production of saliva. It affects 14–40 % of adult population [1, 2]. The presence of saliva usually is taken for granted as it is not required for any life-sustaining functions. Nevertheless, its diminution or absence can cause a reduction in patient's perceptions of quality of life [3, 4]. Decreased salivary flow and alterations in salivary composition cause a clinically significant oral imbalance manifested by increased caries incidence; susceptibility to oral candidosis; burning mouth; sore tongue (glossodynia); difficulties with speech, mastication, and swallowing; altered taste sensation (dysgeusia); and halitosis [5–8]. As elderly

people live longer in association with co-existing medical disorders, the likelihood of developing dry mouth problems increases [9, 10].

Standard head and neck radiotherapy results in serious, often irreversible damage to the major and minor salivary gland tissues. The resultant profound hypo-salivation leads to serious oral health and functional problems that seriously affect oral health-related quality of life (OHRQoL) [11–14].

Intra-oral devices with reservoirs have been developed that allow the release of saliva substitute into the mouth. Devices for use in edentulous patients where the reservoir has been incorporated within a complete denture have proved successful [15–18]. This case report describes an innovative technique for incorporation of saliva reservoir in cast partial denture in patient with post irradiation xerostomia.

Case Report

A 43 year old male patient was referred to Dept of Prosthodontics, Goa dental college and Hospital; with the chief complaint of missing teeth and difficulty in eating and swallowing of food. Patient gave the history of carcinoma of lateral border of the tongue on left side and was treated for the same with combined radiotherapy and chemotherapy 2 years back. Since then patient had the complaint of dryness of oral cavity. On clinical examination, patient had partially edentulous maxillary arch with all molars missing (Fig. 1) and completely edentulous mandibular ridge. Sialometric analysis of the patient was done for the confirmation of xerostomia.

After the thorough examination of the patient and evaluation of the clinical findings; it was decided to give

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Fig. 1 Partially edentulous maxillary arch

the patient an upper cast partial denture with a saliva reservoir incorporated in it in with the help of “precision attachments” and a conventional complete denture for mandibular arch. A variety of modifications in the conventional prosthodontic procedures were planned at each stage according to the clinical situation.

Preliminary Impressions were made in irreversible hydrocolloid impression material considering the fragile nature of mucosa. The preliminary casts were poured in the Type 2 Gypsum Product Custom trays with spacer thickness of 1 mm were constructed for making final impressions using self cure acrylic resin.

Mouth preparations were completed in the upper arch for receiving cast partial denture after surveying the maxillary cast and planning a design which included the complete palatal coverage major connector and Aker’s clasp as a retentive element. Final impression for upper arch was made using condensation silicone putty for the single step border moulding in the custom tray and a wash impression was made with the light body impression material. The final casts were poured in type 3 dental stone.

After the getting the final casts, important step was designing of the reservoir. The saliva reservoir design consisted of 2 parts. Precision attachments were incorporated within saliva reservoir in such a way that—the part with “female” component of the precision attachment was incorporated in cast partial denture and the part with “male” component of the attachment was incorporated in the lid of the reservoir.

As the lid part of the reservoir will be projecting from the cast partial denture towards the tongue, customization of palatal contour was the prime requirement to aid in speech and phonetics. To achieve this, technique proposed was “Palatogram Analysis” [19]. In this technique; patients are told to pronounce ‘sound stimulus statements’ proposed by Tanaka [20] on repeated basis. During this time, a contrasting recording medium is coated on palatal surface of the prosthesis and recording is done by asking the patient to pronounce the statements.

For this patient the “sound stimulus sentences” were very difficult to pronounce as they were in English. In contemplating this problem, some “sound-stimulus words” in DEVNAGARI script to which patient was very much familiar; were written down. These words contained the following ‘Palato-lingual consonants’(s, t, d, n and l). These words were written down and the patient was asked to read it out loud. The patient could pronounce the words with ease and fluency.

For the analysis, a self cure acrylic resin plate was fabricated with the circumferential clasp type retentive elements on the premolars (Fig. 2). The recording medium used was Tissue Conditioner. Patients tongue was coated with the contrasting coloring medium and patient was asked to repeat the words. As the patient had partial ankyloglossia very mild contact in anterior area was recorded. This recording was used as a guide to determine the location of placement of female component of the attachment.

To place these two female components parallel to each other on the waxed framework, Ney surveyor was used (Fig. 3). The assembly was cast, finished and polished



Fig. 2 Palatal plate with the tissue conditioner recording medium showing minimum contact in anterior palatal area during palatogram analysis



Fig. 3 Female components placed parallel to each other; along with the peripheral milled wax

(Fig. 4). The cast partial denture framework was then tried intraorally for the fit and comfort to the patient in its form and function.

Lab putty was used to create the space for the saliva reservoir. For the lid portion of the reservoir, the same shape was replicated in the wax pattern giving specific consideration to the amount of contact in different areas of the palatal surface of the cast partial denture (Fig. 5). Male components were incorporated in the wax pattern and the assembly was cast to get the “2nd part” of the reservoir.

Two apertures of size 0.7 mm were made in the posterior aspect of reservoir for the continuous flow of saliva. This amount was sufficient for a period of 6 h [19] after which patient had to refill the reservoir through these apertures. Saliva substitute used was “E-SALIVA”. Jaw relations were recorded; dentures were acrylised as per the routine procedure. After that the dentures were inserted, occlusal adjustments were carried out and were delivered (Fig. 6).

Strict routine protocol for the follow up was planned; patient was advised to come every week for recall appointment in the first month and there after every 15 days for next 3 months.



Fig. 4 Finished cast partial denture framework



Fig. 5 Wax pattern of lid portion of reservoir with male component of precision attachment; simulating the palatogram analysis



Fig. 6 Finished cast partial denture with reservoir in place

Post-Insertion Care for this patient was very essential. The Patient was advised to spray “E-SALIVA” all around the mouth before insertion of the prosthesis.

Discussion

Previous studies suggest that reservoirs in the palatal aspect of maxillary dentures may also be useful in treating xerostomia. In this prosthesis, the saliva reservoir was constructed in maxillary arch because mandibular saliva reservoir construction as explained in the literature is technique sensitive procedure and requires a careful case selection in terms of undercut present in the denture bearing area [21]. Also as the collection of foods and fluids occur mostly in the floor of the mouth, it might clog the holes of mandibular reservoir.

In this innovative design of the saliva reservoir, MINI-CON V 37580 (BEGO, GERMANY) Friction-Grip Slide Attachment was used. These are the small attachment that can be used intra- or extra-coronally, especially for the bonding of separated, larger split bridges. They are also suitable for the attachment of partial dentures in connection with crown and bridge restorations. These attachments being small in size best suited the design of the reservoir considering the space constraints in the palatal vault.

As this attachment was of sliding type, it was not required for the female component to be covering the male part and thus taking extra vertical space as in case of ball and ring type of attachment. Two parallel sliding type attachments used in this case provided horizontal stability and easy insertion and removal of the lid as well. The size of the attachment used was 5.0×2.8 mm. The trimmed putty index used for providing the space was analyzed to estimate the volume that would be available to accommodate the artificial saliva. The putty index approximately had a volume of 10 cc. So the capacity of the saliva.

Maxillary reservoirs described in the literature before [17] had the lid of the reservoir firmly fixed with cold cure

acrylic resin with the denture base. So once the reservoir has been fitted in the denture, it was unavailable for further cleaning measures. As opposed to which, as the male and female components had friction grip; they were slide in while closing the lid of the reservoir during function. The removal of the lid of the reservoir was carried out in opposite direction of its insertion; thus disengaging the attachment mechanism. As the attachments were used, the insertion and removal of the lid of the reservoir was absolutely precise, in one direction and constantly repeatable for the patient. Thus attachments used made the reservoir **FIXED DETACHABLE PROSTHESIS**, thus providing excellent mechanism for it to be inserted and removed and making it available for cleaning procedures.

An increased prevalence of candidal carriage and Oral Candidiasis is common in cases of xerostomia patients. Most manifestations of Candidiasis are associated with the formation of *Candida* biofilms on surfaces such as prostheses [22]. Evaluation of the study data showed that the metal base surface exhibited significantly less growth of *Candida* species when compared with the heat-cured acrylic resin surface over time [23, 24].

In this innovative design with the use of precision attachments, patient was able to clean the saliva reservoir on a regular basis. The fit of the two parts of the reservoir was accurate. The all metal design of the assembly significantly reduced the weight of the prosthesis and candidal growth in the patient prone to Candidiasis. In this technique accurate palatogram analysis and proper parallel placement of the female component in the waxed framework were the critical determinant to the success.

Conclusion

“2 Piece saliva reservoir” constructed in this case with the use of precision attachment had certainly enhanced the quality of life of the post irradiation xerostomia patient by using the time tested prosthodontic parameters in an innovative way.

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