

Revisiting Special Tray Designs for Complete Denture Impression in An Unusual Case of Posterior Palatal Seal Presentation

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Abstract The complete denture prosthesis is retained in the mouth by a variety of factors; however, the maxillary complete denture retention is largely aided by the proper recording of the posterior palatal seal (PPS) area. Multiple techniques have been described in the literature, with many authors modifying them. However, the principles remain the same. This case report presents an unusual case where the posterior palatal seal area differed in size and extent between the right and left sides. In light of the same, the authors revisit different techniques of recording PPS areas. Various tray and spacer designs have also been discussed, along with their clinical indications and relevance. The patient reported a loose maxillary complete denture prosthesis, which was successfully replaced with a new conventional complete denture. Verification of the efficacy of the PPS area was performed at each subsequent clinical step after primary impression-making.

Keywords: *Soft palate, hard palate, denture retention, complete denture prosthesis, stability*

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1. Introduction

Among the five principal objectives of impression-making in a complete denture prosthesis, the objective of retention of the prosthesis largely depends upon the planned secondary impression that is made immediately after diagnosis and treatment planning. [1] Between the maxillary and the mandibular complete denture prostheses, the influence of gravity works in favor of the mandibular denture while it works against the maxillary complete denture. [2] This makes the maxillary complete denture more vulnerable to retentive failures, which directly impact the patient's attitude toward a complete denture in the long term. Patients tend to develop negative attitudes towards complete denture prostheses more rapidly than they recognize the positive aspects of the prostheses. [3] Patient expectations are addressed by proper education and motivation, as patients tend to forget information provided to them by the clinician. [4] For the maxillary denture to efficiently resist the forces of gravity, the establishment and recording of an accurate and effective posterior palatal seal area (PPS) is mandatory. PPS recording is a clinical step that is part of comprehensive impression-making, and any minor or major errors, if neglected, can lead to clinical failure. [5] The PPS area is defined anteriorly and posteriorly on soft tissue landmarks,

which are highly mobile during function, thereby complicating the recording of the PPS area. Between the two lines is the soft tissue area, which needs to be compressed by the corresponding part of the maxillary complete denture to functional limits. Only then will the objectives of PPS recording be fulfilled. The type of PPS area in a particular individual is completely dependent upon the anatomical and physiological relationship of the hard and soft tissues in that region, especially the muscles of the soft palate. Although tooth loss variations and patterns indicate the overall health of a population, there is little or no relation between PPS type and the presence or absence of teeth. [6] If one would like to describe a PPS area in a simple manner, it will be defined as a particular area on the soft tissue of the posterior palate that is not supported by the underlying bone and moves during soft palate function. Depending on the timing of the complete denture treatment or the stage of fabrication, the technique for recording PPS has been described in the literature. [7], [8] These include the conventional technique in which the PPS is recorded at the time of jaw relations by transferring the anterior and vibrating lines to the trial denture base. [9] The physiological technique of recording PPS requires the area to be compressed either at the border molding or at the try-in stage, although the same can be accomplished at any stage of complete denture fabrication. [8] The advantage of recording PPS during border molding and recording the final impression is that it allows the clinician

to verify the efficacy of the seal before and after recording the final impression, which in turn gives an idea of how well the denture will be retained by the patient. [10]

Anatomical aberrations in the oral cavity are not uncommon. They may either occur in isolation or may occur secondary to other conditions or syndromes. [11], [12] The unified function of the hard and soft palates is to segregate the oral cavity from the nasal cavity while at the same time ensuring that both cavities work together with the pharyngeal cavity. [13] The PPS area also does not follow any standard anatomical guidelines and varies in each individual, although there is less variation between the right and left sides within the same individual. While the anterior and posterior vibrating lines are demarcated for the anterior and posterior extent of the seal area, the height or depth of the PPS area demarcates its compressibility and is one of the most important factors to maintain retention and prevent influx of food during functional movements of the soft palate. [8], [10] The depth of the PPS seal area in the physiologic technique of recording PPS is recorded using either the border molding material or the impression waxes. [14] A proper PPS recording allows more bulk to be built within the denture in the region, which prevents the denture from warping. While balanced contact between the artificial teeth provides patient comfort, the extra thickness in the PPS region allows patients' tongues not to discern the border of the complete denture prosthesis. [15]

This article, in the form of a case report, presents a unique case of a completely edentulous patient whose right side and left side PPS varied in terms of extent and size. The article, in light of the concerned topic, also highlights the significance of tray designs in relation to spacers and relief areas.

2. Case Report

An elderly male patient aged 72 years reported to the department of prosthodontics with a chief complaint of loose, old complete dentures, especially the maxillary denture. Patient's medical, social, drug, and other relevant histories were non-contributory to the future treatment plan. An extra oral examination revealed all parameters within normal limits. Intra-oral examination showed the presence of well-formed maxillary and mandibular residual alveolar ridges (RAR) and the presence of a unilateral posterior undercut in the region of maxillary tuberosity. Functional examination of the existing maxillary complete denture showed that the complete denture has a very ineffective posterior palatal seal, due to which the maxillary denture was less retentive from the posterior aspect despite having the advantage of a mechanical undercut. Palpation of the maxillary arch in the posterior region revealed a broad triangular PPS area between the anterior and posterior vibrating lines, which was triangular in shape (Figure 1A). A primary diagnostic impression was made with an impression compound (Pinnacle, DPI, India), which confirmed the clinical findings of the PPS area (Figures 1B, C). The patient was informed about the reason for the lack of retention of the maxillary complete denture. The treatment plan presented to the patient included an implant-supported fixed

complete denture or implant-supported overdenture for both the maxillary and mandibular arch, a conventional complete denture with balanced occlusion, or rectifying the existing complete denture in the concerned area. The patient consented to a new conventional complete denture with balanced occlusion. Routine clinical and laboratory procedures for complete denture fabrication were conducted to fabricate the maxillary and mandibular complete dentures. In order to make the PPS area effective, the area boundaries were identified and transferred after the primary impression with the impression compound. Based on the area bounded by anterior and posterior vibrating lines, the wax spacer was designed for the special tray. At the time of border molding and final impressions, both anterior and posterior vibrating lines were delineated with a tissue marking pencil, and a low-fusing compound was placed in the designated area of PPS, and the PPS area was recorded. The effectiveness of the PPS area was verified after border molding was completed by observing tray resistance when anterior displacing forces were applied to the tray handle.

The clinical efficiency of PPS was established at the time of jaw relations. At the time of denture insertion, the patient was educated about the use of complete dentures, and all related instructions were given orally and in writing. The patient was asked to follow up after denture delivery at 1 day, 1 week, 3 months, and 12 months. During subsequent patient visits, the patient reported being satisfied with the functioning of the maxillary complete denture.

3. Discussion

The PPS area is one of the most critical anatomical landmarks on the completely edentulous RAR foundation as it delineates the area that can be compressed by the posterior aspect of the complete denture prosthesis to aid in prosthesis retention. The critical nature of this area is because of the muscles of the soft palate that are inserted into the posterior border of the hard palate area. [16] The muscles tend to move with the function of the soft palate in either direction and are more pronounced during speech and deglutition. [17] Different impression techniques are used to record the functional movements of the soft palate, irrespective of the type of complete denture prosthesis (immediate denture or overdenture). [18] Since some of the muscle fibers are attached to the hard palate in such a manner that they overlap the palate, their function tends to dislodge the denture if the extension of the denture in the area is not accurate. [19] Different anatomical landmarks on the maxillary RAR have their own specific significance. Areas can be either primary stress bearing, secondary stress bearing, or relief areas (Figure 1 D). The dimensions of the PPS area depend largely upon the relation of the soft palate to the hard palate, which has been classified into three different types. The PPS area, which is bounded by vibrating lines, delineates an area that can be compressed within physiologic limits by the complete denture prosthesis, thus allowing additional thickness to the denture border posteriorly, which is advantageous in many different ways. [20], [21] Primitive prosthodontic practices for recording this area were

largely the responsibility of the dental technicians who used to scrape the master cast in the region (arbitrary scraping technique) to impart some tissue compression by raising the denture portion in this area. [6] With a better understanding of oral biology, the recording of the area became more objective and physiological. While most of the techniques are based on the stage at which they are recorded, the authors feel that the technique described by Boucher et al. is more advantageous than other techniques. [22] In this technique, the posterior palatal seal area is planned at the primary impression stage, recorded during the final impression stage, and verified at the jaw relations stage. [22] Depending on the spacer used in special tray designs, which may or may not reflect the theory of impression upon which the impression is based, one needs to plan the PPS area. If one is planning to use a full spacer in the special tray, one needs to record both anterior and posterior vibrating lines at the time of primary impression, irrespective of the primary impression material used. Alginate may be favorable since the transfer of anterior and posterior vibrating lines and the tray extent are easily transferable to the laboratory. Depending on the recorded anterior and posterior vibrating lines, the laboratory technician will design the wax spacer (Figure 2A). If the special tray design includes only the relief area, then marking the posterior vibrating line is sufficient to allow the technician to extend the tray posteriorly up to the concerned landmark (Figure 2B). Irrespective of the tray design, the clinician must identify the anterior and posterior vibrating lines at the stage of border molding. Once the lines are demarcated, they must be transferred to the special tray, the exception being the tray with full spacer, where the entire area has been previously delineated. Within the area, the low-fusing compound is then placed, and the tray is inserted to record the area. Once the low-fusing compound hardens, the special tray can be used to verify the effectiveness of the posterior palatal seal area in facilitating retention (vertical pull) and stability (anterior displacement). After making the final wash impression, the posterior palatal seal area must be clearly visible in extent, which will suggest that the PPS area is compressing the tissues (Figure 2C). The objectives of an effective PPS seal in the maxillary complete denture prosthesis will be achieved only if the area is raised in the region but within biologic and acceptable anatomic limits of the area. Clinically, this is evident by the wash impression material being very thin in the area from which the underlying green stick compound is visible (Figure 2D). Any raised portion in front of the anterior vibrating line will work against denture retention, and the denture may not stay in place since the raised portion is compressing the posterior bony palate. PPS area recording thus has multiple steps, which may be summarized as identifying, marking, transferring, recording, and finally verifying its effectiveness. Any clinical technique that does not fulfill any of these steps may be considered to be less advantageous than the one mentioned by Boucher et al. [22] It is also important to note that other techniques are applicable or indicated in certain clinical.

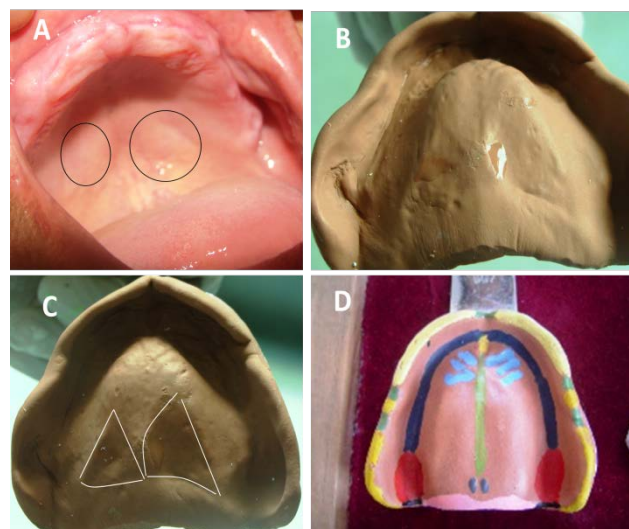


Figure 1. (A) Clinical extension of posterior palatal seal area (B) Primary impression of maxillary arch (C) Extent of PPS area over the primary impression (D) Anatomical landmarks coloured to show primary and secondary stress bearing areas

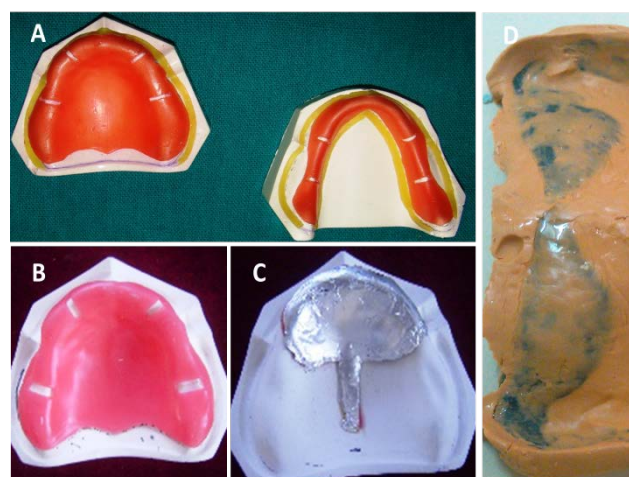


Figure 2. (A) Spacer for impression material on maxillary and mandibular primary casts (B) Spacer design with vertical stops for maxillary tray (C) Secondary stress bearing areas relieved with wax (D) Wash impression showing thin zinc oxide eugenol impression paste over the PPS areas

Situations or when a clinician forgets to record the area during final impression-making. The conventional technique allows recording PPS area during jaw relations, but the technique still needs scraping of the master cast, which gives it an arbitrary depth rather than the required physiological depth. Changes in the complete denture prosthesis in this area are bound to occur during processing and when acrylic resin is stored in water. [23] Water sorption by the acrylic resin is higher in the initial two weeks; therefore, occlusal and non-occlusal changes should be corrected at subsequent follow-up visits. It is also important to note that the biological tolerance to impaired occlusion is extremely low [24]. However, the patient may still wear the prosthesis, but if the border of the denture at the PPS is discernible by the tongue, then the patient may refuse to wear the denture. [25]

Conclusion: PPS area contains multiple different structures with muscles of soft palate being predominant. The correct recording of the PPS area is crucial for aiding complete denture retention. Different special tray designs require different landmarks of PPS to be recorded at different stages of complete denture construction. Correct recording of anterior and posterior vibrating lines delineates the differences in the PPS area between two different sides.

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