

## A Clinical Review of Spacer Design for Conventional Complete Denture

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### Abstract

One of the key factors affecting the outcome of the treatment is the impression procedure involved in the fabrication of complete denture prosthesis. Various impression philosophies have been proposed over years by various authors, out of which the selective-pressure impression technique is most accepted. In this technique, by using custom trays with spacers of different materials and designs, vulnerable tissues are relieved and stresses are distributed selectively to biomechanically sound tissues. But the dentist usually uses stock tray for making primary impression as well as final impression due to the lack of knowledge of the following: optimum material for making custom impression tray, adequate extension, required thickness and designs of spacer, tissue stops, escape holes, tray handles, and polymerization time regarding custom impression trays in prosthodontics. This article will give a clear view to the dentists to use accurate spacer design, material and thickness, tissue stops, and escape holes, based on various clinical situations in their practice.

**Keywords:** Spacer design; Selective-pressure impression; Relief area; Impression material; Clinical situations

### Introduction

The history of impression making for complete denture dates back to the era when wood or ivory blocks were carved to accommodate the intraoral contours. More advanced techniques have come into use today, and this is because of a thorough knowledge of the oral tissues, their behaviour, and their reaction to manipulation for making impressions. The need to make an accurate impression is fundamental to the practice of prosthodontics. This necessitates dental clinicians to make a careful assessment of the tissues to be recorded in the impressions, type of impression trays, impression materials, and techniques to be used. Four basic impression philosophies proposed over years for impression making are: mucostatic, mucocompressive, minimal pressure, and selective-pressure impressions [1-4].

**Mucostatic impression technique** (1938) records denture-bearing tissues in static, undisturbed form by using readily flowing material such as impression plaster. Its disadvantage is that due to the lack of sufficient coverage of denture-bearing area, the denture will have poor retention, stability, and aesthetic appearance.

**Mucocompressive impression** technique records the tissues in their functional form so as to provide denture stability during function. This technique is not very encouraging as it will lead to continuous pressure, resulting in residual ridge resorption. It will also compromise denture retention, as the displaced tissue during function tends to rebound at rest.

**Minimal-pressure technique** is a compromise between mucostatic and mucocompressive techniques. In this technique, the minimal possible pressure, i.e., little more than the weight of free-flowing material is applied during recording denture-bearing tissues. Limitation of this technique is that there is lack of standardized protocol regarding the amount of pressure to be applied during impression.

**Selective-pressure impression** concept combines the minimal-pressure and mucocompressive philosophies. The spacer design for the selective pressure is directly governed by the knowledge of the

stress-bearing and relief areas. The stress-bearing areas in the maxillary arch are the horizontal plates of the palatine bone, and the relieving areas are midpalatine raphe and the incisive papilla. For the mandible, the primary stress-bearing area is buccal shelf area and relieving area is a sharp mylohyoid ridge and the crest of alveolar ridge. Selective pressure can be achieved either by scraping of the primary impression in selected areas or by fabrication of a custom (special) tray with a proper spacer design and escape holes (relief). The latter is more reliable because of the accuracy with which we can achieve variable thickness in the impression material (because of variable thickness of wax spacer) and thereby achieve variable compression of tissues at different areas (selective pressure at selected areas). But views of different authors on how to achieve selective-pressure impression are different. Though custom impression trays are used for making final impression in complete denture, there is inadequate knowledge of custom-impression tray design among clinicians and most of the clinicians depend upon lab technicians to design them.

Out of various impression philosophies proposed over years, the selective-pressure impression technique is most accepted. It combines the principles of both mucocompressive and minimal-pressure techniques, which were proposed by Carl O. Boucher [2]. The importance of an in-depth review of impression making for complete dentures lies in the assessment of the historical value of all the factors related to physical, biologic, and behavioral areas and the time in which they were discussed and taught as well [3-9].

### Spacer Design by Different Authors

**Boucher**, based on selective-pressure technique, advocated the placement of 1 mm base-plate wax on the entire basal seat area except posterior palatal seal (PPS) area. According to him, PPS will act as guiding stop to position the tray properly during impression procedures. He also advocated the placement of escape holes with no. 6 round bur in the palatal region, and 1 mm thick base-plate wax covers mandibular ridge except buccal shelf area and retromolar pad (Figure 1) [1].

**Morrow, Rudd, and Rhoads**, based on minimal-pressure technique, recommend blocking out undercut areas with wax and then

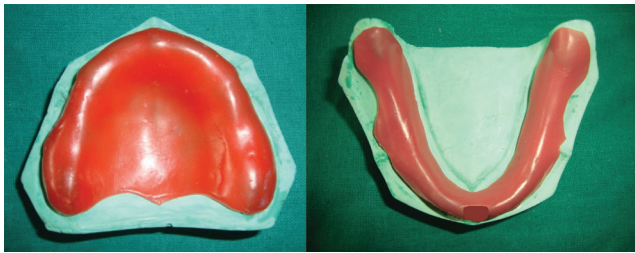


Figure 1: Boucher's spacer design for maxillary arch and mandibular arch

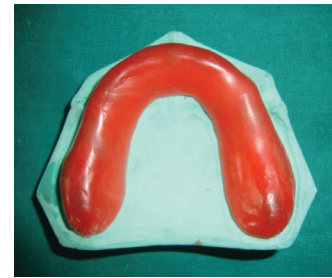


Figure 4: Bernard and Levin's spacer design for maxillary arch



Figure 2: Morrow, Rudd, and Rhoads' spacer design for maxillary arch

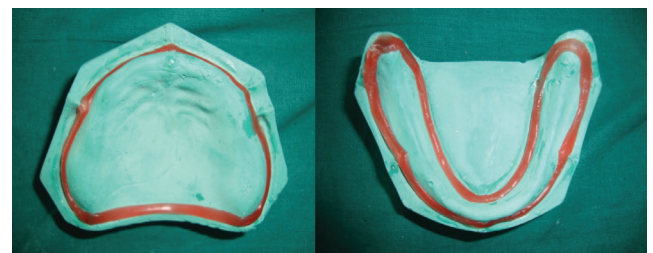


Figure 5: Halperin's spacer design for maxillary arch and mandibular arch

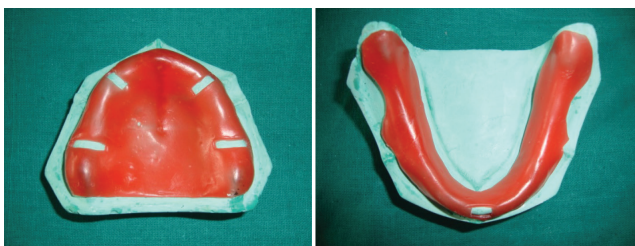


Figure 3: J. J. Sharry's spacer design for maxillary arch and mandibular arch



Figure 6: A. Roy Mac Gregor's spacer design for maxillary arch

adapting a full wax spacer 2 mm short of the resin special tray border all over. Then they recommend placement of three tissue stops ( $4 \times 4$  mm) equidistant from each other [4] (Figure 2).

**Sharry**, based on minimal-pressure technique, recommends adaptation of a layer of base-plate wax over the whole area outlined for tray (even in PPS area). He recommends the placement of four tissue stops (2 mm in width located in molar and cuspid regions which should extend from palatal aspect of the ridge to the mucobuccal fold) and one vent hole in the incisive papilla region before making the final impression with the metallic oxide impression material (Figure 3) [7].

**Bernard**, based on selective pressure technique, recommends a layer of pink base-plate wax (about 2 mm thick) attached to the areas of the cast that usually have the areas of softer tissues; he recommends the placement of wax spacer all around, except the posterior part of the palate, which according to him are at high angles to the occlusal forces [8]. Not employed as midpalatine raphe, not relieved, and exposed palatal area acts as a stopper (Figure 4).

**Halperin** recommended the "custom tray" with peripheral relief. He suggested the custom trays be provided with 1 mm thick wax relief over

the peripheral extensions and buccal slope regions of tray including PPS region and that the custom tray be in intimate contact with basal seat areas. This provides the internal finish line that forms a butt joint of the compound to the tray after border molding is completed. No secondary wash impression is needed as tray surface and border-molded areas acts as final impression surface. A master cast is directly poured into border-molded trays without using wash impression [9] (Figure 5).

**Mac Gregor**, based on selective pressure technique, recommends placement of a sheet of metal foil in the region of incisive papilla and midpalatine raphe. He also says that the other areas that may require relief are maxillary rugae, areas of mucosal damage, and buccal surface of the prominent tuberosities. Finally, he concludes that the relief should not be used routinely in the dentures [10] (Figure 6).

**Neill** recommends the adaptation of 0.9 mm casing wax all over except PPS area [11] (Figure 7).

**Heartwell** mentions two techniques for achieving selective pressure for maxillary impressions. In the first technique, he makes the



Figure 7: Neil's spacer design for maxillary arch



Figure 8: Sheldon's spacer design for maxillary arch

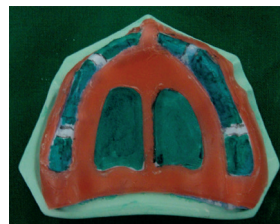


Figure 9: Sanath Shetty's spacer design for maxillary arch



Figure 10: Dale E. Smith's spacer design for maxillary arch

primary impression with impression compound in a nonperforated stock tray; the borders are refined. Later, space is provided in selected areas by scraping of the impression compound. In the second technique, he recommends the fabrication of a custom tray (but did not mention about the wax spacer). Border molding is done with low fusing compound. He recommends the placement of five relief holes on the palatal region (three in the rugae area and two in the glandular region) before making the secondary impression with zinc oxide eugenol (ZOE) paste [12].

**Sheldon** describes two techniques. In the first technique, the primary impression is made with low-fusing modelling compound (Kerr white cake compound). The borders are refined with Kerr green stick compound. Once the operator is satisfied with the retention, selective relief is accomplished by scraping in the region of incisive papilla, rugae, and mid palatal areas (Figure 8). In the second technique, he describes of making an alginate primary impression. A primary cast is poured. After analysis of cast contours, undercuts are blocked out. Later, he recommends the placement of spacer or pressure control (but did not mention clearly about the wax spacer design). Border molding is done with green stick compound before making the secondary impression with ZOE paste [13], based on selective-pressure technique used on high arched palate.

**Shetty** described a technique in which a thin sheet of wax (0.4 mm major connector wax [Renfert, Germany]) is required to be placed in all areas except the PPS area, as this area needs to be compressed during the border-molding procedures. A 1.5 mm thick layer of modelling wax is applied on top of the already adapted wax sheet. The modelling wax is removed in the region of the crest of the alveolar ridge and the horizontal palate, as these are stress-bearing areas [14] (Figure 9).

In **Smith's design**, 1 mm thick base-plate wax covers the ridge and midpalatine raphe. Two tissue stops, each at the canine region and exposed hard palate, help in proper vertical seating of the tray and control the thickness of impression material [15] (Figure 10).

#### Miscellaneous design for maxillary arch

Based on minimal-pressure technique, a 1 mm base-plate wax is placed over the basal area except right and left posterior hard palate. Four tissue stoppers, each at canine and molar regions and the exposed areas act as stoppers. The material of choice is rubber [16-20] (Figure 11).

#### Miscellaneous design for mandibular arch

Based on selective-pressure technique, a 1 mm thick base-plate wax is placed over the entire alveolar ridge except at the retromolar pad area. Tissue stops are placed, each at canine region, bilaterally. Full coverage with tissue stops provides uniform thickness of impression material.



Figure 11: Miscellaneous spacer design for maxillary arch



Figure 12: Miscellaneous spacer design for mandibular arch

The exposed retromolar pad acts as the stress-bearing area [21-25] (Figure 12).

#### Spacer Design for Undesirable Clinical Situation

(**Partial spacers**) covers the specific tissues.

I-spacer in maxillary arch, based on selective-pressure technique, covers the incisive papilla and midpalatine raphe when it is prominent (Figure 13).

T-spacer covers the anterior residual alveolar ridge in maxilla when it is resorbed and flabby. It is based on selective-pressure technique; it also covers the prominent incisive papilla, rugae and midpalatine raphe, and the exposed areas act as stoppers. Partial spacer designs in the mandible cover only the anterior residual alveolar ridge when it is atrophic, resorbed, or flabby [26-29]. This is based on selective-pressure technique; the spacer placed on relieving areas and the exposed areas acts as stoppers (Figure 14).

#### Classification of Spacer Designs

**Full spacers** cover the entire residual ridge except PPS area in maxilla and buccal shelf and retromylohyoid area in the mandible. This provides space for impression material.

**Partial spacers**, like I-spacer and T-spacer, cover specific tissues based on different clinical situations.

**Spacers with tissue stops** have windows of 2 mm width cut at canine and molar regions bilaterally. Tissue stops will help in proper vertical seating of the impression tray, they and control the thickness of the impression material [30].

#### Spacer Thickness

Ideal thicknesses of wax spacer for completely edentulous and partially edentulous situations are 1 and 3 mm, respectively. The thickness





Figure 13: I-spacer design for maxillary arch

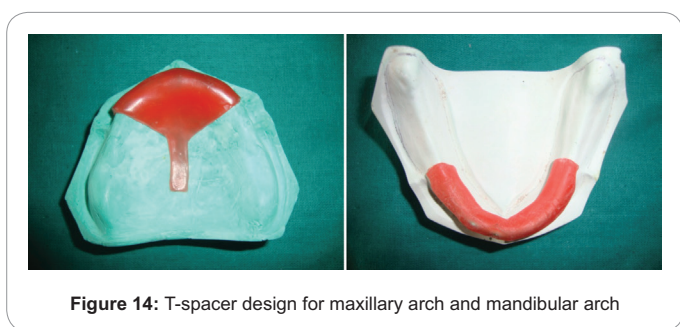


Figure 14: T-spacer design for maxillary arch and mandibular arch

Clinical situation	Impression material	Spacer design and thickness
Nonundercut ridges	i) Impression plaster ii) Zinc oxide eugenol	2 mm spacer with tissue stops 0.5 mm spacer
Nonundercut and undercut ridges	i) Alginate ii) Elastomeric impression materials: a. Polysulfide b. Silicones	3 mm spacer with tissue stops 1.5 mm spacer with tissue stops 3 mm spacer
Displaceable tissues	ZOE paste, impression plaster and various elastomers	Spacer design and thickness variable based on clinical situation

Table 1: Spacer design and thickness for various impression materials

of spacer is determined by the type of impression material in the making of final impression and clinical situation as given in (Table 1).

### Spacer Materials Used Over the Years [31]

- **Tin foil**, first recommended by Roy Mac Gregory in the region of incisive papilla and midpalatine raphe.
- **Casting wax** in thickness of 0.9 mm advocated by Neil and to be adapted all over except PPS area.
- **Nonasbestos ring liner (wet)** used as spacer when shellac is used for custom tray fabrication.
- **Base-plate wax** used as spacer when acrylic resin is used for custom tray fabrication.

### Contraindication for Spacer

There is no absolute contraindication as such, but in cases of highly resorbed ridges, spacer is not used as a solid tray is easier to manage. In such cases, carbide bur can be used to remove about 1 mm of the custom tray material from the crest of ridge area.

### Discussion

Recording of denture-bearing tissues for complete dentures is important from many aspects like health of the tissues, function, and retention of dentures. As well said, "Preservation of what remains is more important than meticulous replacement of what is lost", same is applicable to complete denture impressions. Proper knowledge of the anatomy of denture-bearing areas and the use of custom tray with a proper spacer design and its application during impression making is of utmost importance for stable, retentive prostheses that is in harmony with surrounding and underlying tissues. Frank has shown that least displacement will occur when an impression tray has relief space and escape holes [17].

### Conclusion

The success of complete dentures largely depends on accuracy of impression. While making impression, one should apply pressure selectively only in certain areas, which can withstand the forces of mastication to minimize the possibility of soft-tissue abuse and bone resorption. This review shows that a wide range of spacer design is available for different situations. Based on the particular condition, the dentist needs to select spacer design for the success of complete denture therapy.

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