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Conventional Spacers in Removable Complete Denture Prosthodontics

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ABSTRACT

Complete dentures offer the replacement of all missing teeth and surrounding tissues. Replacing the entire arch of missing teeth, the prosthesis is exclusively tissue-supported. Adapting a spacer during removable complete denture impression-making is one of the important steps. The success and failure of complete denture therapy are largely dependent upon the method by which the clinician records impressions. Many theories of impression have been proposed and the selective-pressure technique is one of the most widely used theories and has been used successfully. During the selective pressure technique, custom trays with different designs and materials spacers are used so that vulnerable tissues are relieved of undue stresses while stress-bearing areas are utilized properly. The current paper mainly describes some of the conventional wax spacers that may be used during impression making of removable complete denture prostheses.

Keywords: Complete denture prosthesis, Impressions, Removable Prosthodontics, Spacers, Selective pressure technique.

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INTRODUCTION

The use of impression materials dates back to the mid-seventeenth century when German military surgeon, Gottfried Purman started practicing the procedure. During the 18th century, impression techniques involving the use of carved bone pieces or ivory were reported. These blocks were then used to accommodate the intra-oral contours [1,2]. Beeswax has been described as the first material which was used to replicate the oral tissues. During the 20th century, significant advancements in the development of impression materials have taken place and the digitization of dental impression-making nowadays is the latest step forward in the field of clinical dentistry[3,4]. However; despite the advancements in the field of digital dentistry, its procedural technique implementation is not as fast as its technical development [5].

Accurate impression-making is fundamental to the practice of complete denture prosthodontics and recording the functional impression is one of the most critical steps. Although zinc-oxide eugenol has been extensively used for functional impressions of complete dentures, the use of elastomeric impressions is becoming common because of their better clinical properties[2]. Table 1 outlines certain advantages and disadvantages of elastomers. Regardless of any material that is to be used, the clinicians must carry out a careful assessment of the intra-oral tissues before the impression is necessary adequate trays are selected and appropriate impression material and technique are selected [6].

Table 1: Advantages and Disadvantages of Elastomeric Impression Materials.

Material	Advantages	Disadvantages	Recommended Use	Precautions
Polysulphides	Long working time, good tear resistance, easy pouring	Offensive odor, messy, long setting time	Full arch dentate impressions	pouring within 1 hour, leave for 10 mins after pouring
Polyethers	Good dimensional stability, short setting time	Short working time, imbibition in material, set material very hard	Fixed prosthodontics	Pour as soon as possible, to avoid fracture of the cast during impression removal
Condensation cured silicones	Pleasant odor, good tear resistance, good elastic properties	Hydrophobic, poor dimensional stability	Most impressions	Pour immediately, isolation is a must during impression-taking
Addition cured silicones	Pleasant odor, excellent dimensional stability	Expensive, hydrophobic	Most impressions	Pour as soon as possible, isolation necessary for hydrophobic type

When the above-mentioned factors are taken into consideration before the procedure, conventional complete denture impressions taken using high-precision impression materials show a great degree of accuracy[7,8]. Four theories of impression making have been described in the literature which are: muco-static, muco-compressive, minimal pressure, and selective-pressure impression theory, and out of these all, the selective-pressure technique/theory is considered to be most appropriate in clinical dental prosthetics[9,10,11].

During the selective pressure technique, custom trays with different designs and materials spacers are used so that vulnerable tissues are relieved of undue stresses [11]. These spacers can be used under a variety of conditions and offer several advantages principally, to distribute the undue stresses selectively to the biomechanically sound tissues[12]. By using this technique, the objectives of retention, stability, and support can be achieved effectively[13].

Literature extensively suggests various methods of obtaining space below a customized tray before the wash impression[14,15,16]. Custom trays ensure that during the final impression procedure, the thickness of the material remains uniform and that there is less distortion and material wastage. During impression making of complete dentures, the adaptation of spaces has a vital role during the procedure. Although they are advantageous, the problem of non-uniform thickness and difficulty in removal from acrylic resin cannot be ruled out[17]. In cases where a flabby ridge is present, a thickness of at least 3mm is desirable. The current paper mainly describes some of the common conventional wax spacers that may be used during impression making of removable complete denture prostheses.

1. Preserving the Spacer Thickness

Conventional dental impression techniques are still commonly used during the construction of complete dentures even though there have been many advances in terms of the use of computer-aided design/ computer-aided manufacturing (CAD/-CAM) in dentistry [18,19,20,21]. It is essential that the custom tray if required, is fabricated precisely to achieve accuracy of the final impressions [22]. Light-activated polymers have simplified many procedures in the field of removable prosthodontics [23] however; the use of self-cured acrylic resin with a wax spacer remains one of the commonest methods of custom tray fabrication in prosthetic dentistry [24,12].

The usual heat of polymerization in auto-polymerizing resin ranges from 71°C to 91°C varying with the thickness of the material [25]. The wax that is used to fabricate the spacer for custom tray fabrication has a melting temperature of around 45°C. Thus, the polymerization will lead to obvious distortion of the wax and may result in a custom tray which is not accurate. Cellulose acetate sheet, if used is effective in preventing the distortion of the wax space [26]. However, it has also been shown that a spacer with a 2-4mm thickness is acceptable for making a denture impression, and its thickness is not affected by repeated pouring of up to 2 times [27,28]. Figure 1 shows a thickness gauge used to measure the thickness of a spacer that had been fabricated before custom tray fabrication on a maxillary master cast.

Figure 1: Determination of Spacer Thickness is Being Checked Using a Thickness Gauge.

2. Recommended Materials and Tray Stabilization

Many materials have been recommended for spacer construction in the dental laboratory [29,30,31]. Tin foil, baseplate wax, casting wax and non-asbestos ring liner have been recommended. The choice of material is technique-dependent and may vary from case to case. It is also recommended that the tissue stops are placed strategically as they provide even thickness of the impression materials in the custom tray [31]. The use of tissue stops is recommended which should be fabricated at an angle of 45 degrees (from the occlusal surface) and should ideally have a tripod-shaped arrangement over the dental arch. These will ensure that the impression tray is stabilized during insertion and removal [30,32].

During a micro-strain analysis, it was concluded that the use of tray with tissue stops and relief areas resulted in even pressure distribution at the alveolar crestal areas [32]. Their findings were very useful for those impression techniques where preservation of the edentulous ridges was required. The use of electronic measuring devices for measuring forces in dentistry can be found in literature [33]. The success of any impression technique will vary and depends on the experience of a clinician and the choice of impression material. It is worth mentioning that the impression pressure can be controlled by the design of the tray, the type of spacer and the design of the impression tray [34].

3. Spacer Designs for Removable Prosthodontics:

3(a). Boucher's Spacers: Being one of the most common spacer types in removable complete denture prosthodontics, it creates a space of 1mm below the special tray. It covers the entire denture-bearing tissues except for the posterior palatal seal area in the maxillary arch, part of the retro-molar pad region and the buccal shelf area in the mandibular arch Figure 2a and b.

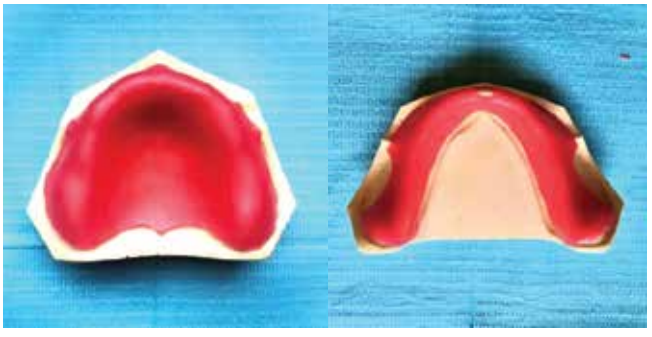

Figure 2(a): Boucher's spacer for maxillary arch (b) Boucher's Spacer for Mandibular Arch

Leaving behind these areas should ensure that the impression tray is stabilized during the impression procedure [35,36].

3(b). **Morrow, Rudd, and Rhoads Spacers:** These types are based on the principle of minimal pressure technique. The authors recommended that the undercut areas over the residual alveolar ridges be blocked using wax first [37]. Once this is achieved, a full wax spacer of 2mm thickness, short of the vestibular areas is fabricated. The authors also recommended that space for tissue stops be made, at equal distance from each other, usually 1 in the anterior region and 2 in the posterior region Figure 3.

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Figure 3: Morrow, Rudd, and Rhoad's Spacers for Maxillary Edentulous Arch

3(c). Sharry Spacers: This design is also based on the minimal-pressure impression technique. This is very similar to Boucher's spacers where base-plate wax is applied to create the space over the entire residual ridge area, also involving the posterior palatal seal region Figure 4.

Figure 4: Sharry Spacers for Maxillary Arch

They recommended placement of four tissue stops which should be located in the molar and pre-molar regions where possible [38].

3(d). Mac Gregor Spacers: This type of spacer involves the use of a metal foil sheet in the anterior region (incisive papilla and mid-palatine raphae) of the maxillary arch Figure 5 [39].

Figure 5: Mac Gregor Spacer for Maxillary Arch

Rugae and other areas where mucosal damage is suspected may also be covered. However; this type of spacer is not routinely used during impression-making in removable prosthodontics.

3(e) Sheldon Spacers: Sheldon described a unique shape of the spacer in Figure 6 which may be used whilst recording the impression of the completely edentulous arches[40].

Figure 6: Sheldon Spacer for Maxillary Arch.

They recommended that a primary impression using a low-fusing modeling compound of the entire denture bearing area is recorded followed by border molding with the green stick compound. Selective relief is then achieved by scraping the region of rugae, mid-palatal areas, and the incisive papilla. Another way of using the spacer, as described by the authors is when an alginate impression is recorded and a cast is poured in the laboratory. The spacer is placed, border molding is done and a secondary impression is recorded using zinc-oxide eugenol paste.

DISCUSSION

The use of additional cured silicones has revolutionized the field of fixed prosthodontics as they have almost perfect dimensional stability and tear strength. Since they can reproduce the details very well, the need for a secondary impression for complete denture patients is becoming less important [41,42]. When the effect of complete dentures fabricated using selective pressure and functional techniques with spacers, was compared in a randomized clinical trial, it was concluded that both selective and functional techniques offer predictable results for patients with severely resorbed ridges [43]. It is important to mention the use of implant-supported prostheses which have revolutionized functional and aesthetic rehabilitation of patients[43,44, 45]. The quality of the final dental prosthesis is largely dependent on the accuracy of definitive impressions in prosthodontics[46]. Elastic impression materials are commonly used in the traditional approach to replicate anatomical structures while indirectly fabricating prostheses. Digital impression has gained increasing popularity due to its various advantages, including three-dimensional previsualization, cost-effectiveness, and reduced time consumption [46,47]. Digital impressions using scanners eliminate the need for additional patient visits, save laboratory costs, and offer a high degree of accuracy [48]. However, it is important to mention that there are many limitations and challenges which are encountered with the use of digital impressions. There are high costs of acquiring the equipment used for digital impressions. The use of digital impression software also requires significant training [49]. In cases where digital impressions and newer techniques cannot be applied, the conventional denture impressions with the use of spacers offer the best alternative.

CONCLUSION

The retention in complete denture prostheses largely depends upon the clinical expertise and the skills of the laboratory technician. Impression making is done during the initial visits of complete denture therapy and it is of paramount importance that an accurate impression is recorded. Spacers are of paramount importance when the clinician chooses the selective pressure technique for complete dentures. The spacers described above can be effectively chosen by the operator, depending upon a specific clinical situation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

All authors equally contribute.

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