

## Case Report

# Fabrication of custom overdenture attachments using indigenously made parallelometer: A technique

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### Abstract

Various types of attachments have been used during overdenture fabrication; however, no single attachment is perfect for every case. Irrespective of the attachment used, it is important to maintain parallelism between the attachments for ease of insertion and removal, functional efficiency, and durability of the prosthesis. It is challenging to obtain parallelism between attachments when the abutments are divergent, or multiple abutments are engaged. A simplified technique to fabricate cast overdenture attachments using indigenously made parallelometer has been described. This technique eliminates the need of making full-arch impressions and models and surveying the attachments before casting. With this technique, there is a reduction in the duration and cost of treatment, without any compromise in quality of the prosthesis.

**Keywords:** Geriatric, overdenture attachments, parallelometer, postpatterns, retention


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### INTRODUCTION

Overdenture is a dental prosthesis that covers and is partially supported by natural teeth, natural tooth roots, or dental implants.<sup>[1]</sup> Tooth-supported overdentures have various advantages over conventional complete dentures such as alveolar bone maintenance, preservation of periodontal proprioception, improved retention, stability and support, enhanced psychological comfort, and increased masticatory efficiency.<sup>[2]</sup> Chen *et al.* observed that the patients treated with tooth-supported overdentures had significantly more comparative masticatory efficiency than those with conventional complete dentures, while there was an insignificant difference in comparative masticatory efficiency between tooth-supported overdentures and implant-supported overdentures.<sup>[3]</sup> Further,

tooth-supported overdentures have notable advantages over implant-supported overdentures such as the presence of periodontal sensory feedback, reduced costs, and nonsurgical placement. Published literature evidence indicates a global increase in life expectancy of the elderly population.<sup>[4]</sup> Because of increased awareness toward dental health and improved oral hygiene practices, an increase in number of the elderly with few teeth remaining, in comparison to the completely edentulous patients, has been observed.<sup>[4]</sup> Clinicians may present various treatment modalities to these patients, such as extraction of remaining teeth followed by conventional complete dentures or implant-supported overdentures or preservation of remaining natural teeth followed by tooth-supported overdentures. The two implant-supported overdentures may be considered as the minimum standard of care for

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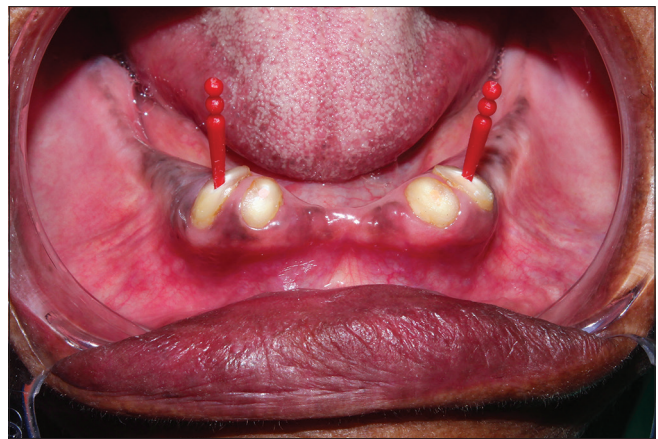
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edentulous patients, but it involves mild to complex surgical and prosthodontic procedures and increased cost of treatment. Hence, tooth-supported overdentures represent a valuable treatment modality for the partially edentulous elderly population.

Frequently, overdentures are supported using attachments fabricated from castable plastic patterns.<sup>[5-7]</sup> Typically, fabrication of such cast overdenture attachments from the castable patterns involves the following steps: postspace preparation and impression making of potential abutments, preparing the working model and attachment of castable attachments (patrix/male component) to the postpattern, surveying procedure to obtain parallelism between the attachments, and casting of the postattachment assembly, followed by their cementation into the abutments.<sup>[5-7]</sup> Following sections present an alternative technique for fabrication of cast overdenture attachments using an indigenously made parallelometer. This technique eliminates the need of making full-arch impression, preparing working models, and surveying procedure. There is a concomitant reduction in duration and cost of treatment, without any compromise in accuracy. The said parallelometer consists of a handle, two miniplates that slide past each other horizontally, and two analyzer rods which remain parallel to each other in any given relationship of miniplates. The compact nature of parallelometer facilitates its use intraorally.

## TECHNIQUE

1. Carry out endodontic treatment of potential abutments following standard treatment protocol. Section the crowns of abutments 2 mm above the gingival margin using high-speed rotary instrumentation under coolant irrigation. Prepare the abutments in dome-shaped contour and hemispherically rounded in all dimensions
2. Duplicate the head portion of a commercially available overdenture attachment using polyvinyl siloxane putty and pattern resin.<sup>[6,7]</sup> Alternatively, prefabricated castable attachment such as Sterngold attachment may be used<sup>[5]</sup>
3. Prepare the postspace in abutments using standard technique and make impressions of postspace using preformed acrylic dowel (Pinjets) and pattern resin [Figure 1]. Remove the postspace impression, trim off excess resin, and place the impression in postspace again. Section the postspace impression at the level of access cavity while the impression is still in the postspace [Figure 2]
4. Slide the horizontal miniplates of parallelometer past each other so that the two analyzer rods extend exactly

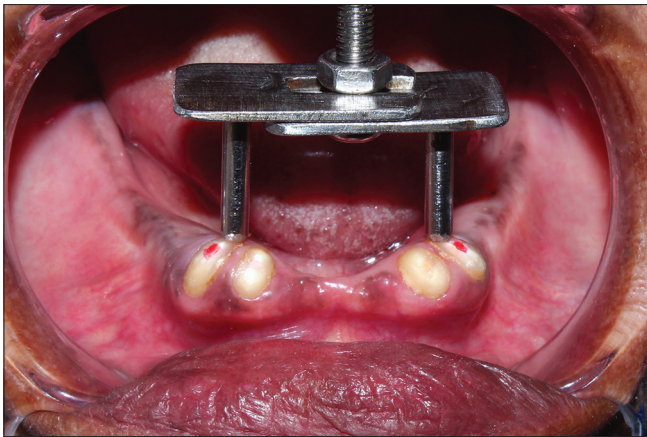


**Figure 1:** Endodontic treatment and postspace preparation performed in abutments. Divergence of Pinjets indicates that long axes of abutments are nonparallel

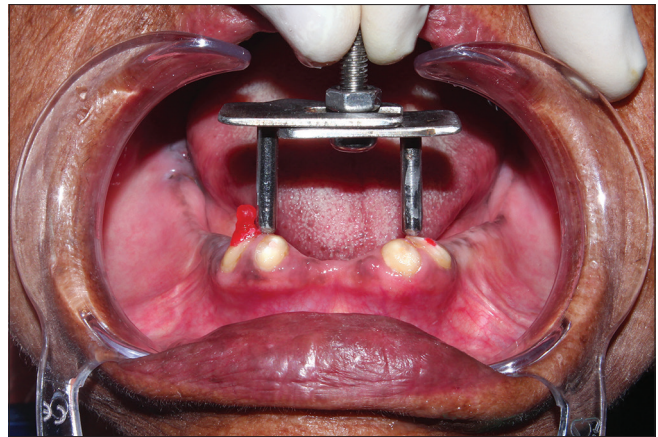
- up to circumference of postspace cavity [Figure 2]. This position of analyzer rods is desirable while connecting castable attachment to pattern resin post
5. Place the parallelometer intraorally with the previously described position of analyzer rods and close to the pattern resin posts. Add freshly mixed pattern resin on cut portion of pattern resin post and place the head portion of attachment on the pattern resin post. Adjust the head portion of attachment parallel to analyzer rod and maintain it in that position until pattern resin sets [Figure 3]. Remove the one-piece pattern resin postattachment, trim off excess resin, and place into the abutment again
6. Repeat the procedure for contralateral abutment. Use the parallelometer judiciously to maintain head portion of castable attachment parallel to the attachment on opposite side [Figure 4]
7. Remove the pattern resin postattachments from abutments [Figure 5] and perform casting procedure using cobalt chrome alloy [Figure 6]. Try and adjust the casted attachments intraorally, carry out their cementation into postspaces, and remove excess luting cement after initial setting of the luting agent [Figure 7]
8. Fabricate the complete denture following established prosthodontic principles. Attach the O-ring attachments to the denture using previously described techniques [Figure 8]. Instruct the patient regarding use and aftercare of the prosthesis and schedule periodic recalls.

## DISCUSSION

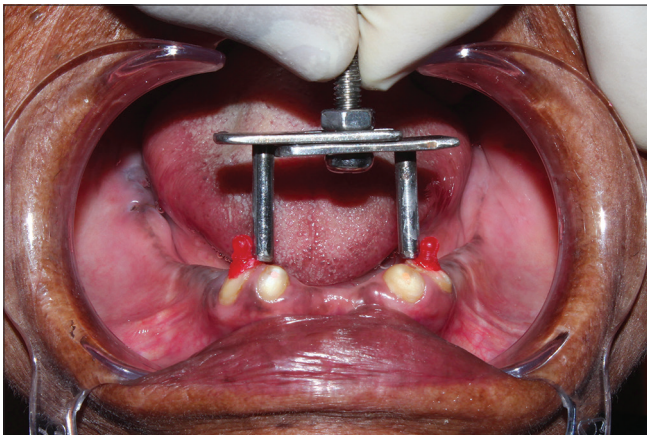
A need to obtain parallelism is frequently encountered in prosthodontic practice, for instance, during tooth preparations, preparing guiding planes, implant osteotomy, and overdenture fabrication using castable attachments.



**Figure 2:** Postspace impressions were made and sectioned near access opening. Analyzer rods of parallelometer were moved close to the impression post



**Figure 3:** Castable overdenture attachment is connected to the impression post using pattern resin, while keeping it parallel to analyzer rod as resin sets



**Figure 4:** Attachment on contralateral side connected to impression post, taking care that it remains parallel to analyzer rod



**Figure 5:** One-piece impression postattachment assembly can be casted directly. The use of parallelometer eliminated the need for pickup impression and surveying



**Figure 6:** Custom overdenture attachments with sleeves



**Figure 7:** Custom overdenture attachments cemented into abutment teeth

A number of researchers have developed paralleling tools to aid the clinician in obtaining parallelism; however, many of them have gone into disuse due to factors such complexity

of use, large size, limited range of movements, increased number of appointments, and cost factors.<sup>[8-10]</sup> Brodbelt has described fabrication of a paralleling template using acrylic



**Figure 8:** Sleeves incorporated in mandibular overdenture using autopolymerizing resin

resin plate and prefabricated metal inserts.<sup>[9]</sup> Fabrication of the template requires additional laboratory time and cost as patient's working cast and dental surveyor are required during the process. Moreover, a tool fabricated in this way is patient specific and cannot be used in another patient. Canning has described a method for transferring guiding planes from a diagnostic cast to the mouth, using jigs made on the diagnostic casts.<sup>[10]</sup> This method also requires additional laboratory time and cost, since new jigs need to be prepared for every patient. An "intraoral surveyor" described by McCarthy has similar disadvantages.<sup>[11]</sup>

The parallelometer described in this article overcomes the above disadvantages due to its simple design, compact nature, and ease of fabrication. The parallelometer was fabricated in engineering workshop using simple mechanical instruments and readily available material, i.e., 307-L stainless steel. The instrument consists of a handle, two miniplates that slide past each other horizontally, and two analyzer rods. The length of the handle is 20 mm while the diameters of the handle and analyzer rods are 3 mm and 1.75 mm, respectively. Each miniplate is 2-mm thick, 1-cm wide, and 2 cm in length. The length of analyzer rod is 18 mm on one side and 20 mm on another side to compensate for the thickness of the miniplate. The analyzer rods were soldered to miniplates at right angles and evaluated for accuracy using a reflex metrograph. Commercial production of the instrument is possible by forging technique.

Borges *et al.* compared the accuracy of an intraoral paralleling device using gypsum casts. Thirty gypsum casts were divided into two groups in which the guiding planes were prepared on selected teeth using either a conventional dental surveyor or the intraoral paralleling device. Guiding planes were prepared on the distal surface of the maxillary

left canine, on the mesial and distal surfaces of the maxillary left second molar, and on the distal surface of the maxillary right canine. The prepared surface on each tooth formed an angle related to the occlusal plane that was measured using a tridimensional coordinate machine, and data were analyzed. A similar study may be conducted to further evaluate the accuracy of intraoral parallelometer described in this article.

Authors performed a literature search to find out finite element studies to evaluate the effect of tooth-supported overdentures on divergent abutments; however, no studies were found. Favorable results were observed in long-term clinical trials related to tooth-supported overdentures conducted by Toolman and Ettinger, but there is no specific mention about the degree of divergence of roots in patients evaluated.<sup>[12,13]</sup> Typically, commercially available prefabricated attachments are available in the range of 10°–20°. Hence, based on the empirical evidence, it can be stated that this technique may be used up to a root divergence of 20°.

Various types of attachments have been used during overdenture fabrication; however, no single attachment is perfect for every case.<sup>[2]</sup> Irrespective of the attachment used, it is important to maintain parallelism between the attachments for ease of insertion and removal, functional efficiency, and durability of the prosthesis.<sup>[5,6]</sup> It is challenging to obtain parallelism between attachments when the abutments are divergent, or multiple abutments are engaged. To address this problem, while using castable attachments, a pick-up impression of the arch with postpatterns is made.<sup>[5]</sup> Later, working cast is obtained, and castable attachments are connected to the postpattern. Surveying is performed to obtain the parallelism, and casting is carried out.<sup>[5]</sup> The present technique eliminates the need to make impressions, casts, and surveying procedure, since connection of castable attachment to pattern resin post is performed intraorally using the parallelometer. The casting procedure of postattachment assembly can be performed without delay, since the need for surveying the attachments using a dental surveyor is obviated. This results in reduced duration and cost of treatment without any compromise in accuracy. The parallelometer described in this technique can also be used for other clinical applications, such as evaluating parallelism of abutments during tooth preparations, and for parallel placement of dental implants and parallel placement of guiding planes.

## SUMMARY

A simplified technique to fabricate cast overdenture attachments using indigenously made parallelometer has

been described. This technique eliminates the need of making full-arch impressions and models and surveying the attachments before casting. With this technique, obtaining parallelism of castable attachment patterns remains a chairside procedure. There is a concomitant reduction in duration and cost of treatment, without any compromise in quality of the prosthesis.

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### Conflicts of interest

There are no conflicts of interest.

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