

# Piezography: An Innovative Technique in Complete Denture Fabrication

Jayanta Bhattacharyya, Preeti Goel, Soumitra Ghosh, Samiran Das

## ABSTRACT

Increasing life expectancy, age-related reduction in adaptability and progressive severe mandibular resorption, all add to the difficulty in achieving prosthetic success. The conventional mandibular denture is usually less retentive than the maxillary one and successful treatment involves the development of lingual retention for the mandibular denture. Several methods taking into account physiologic function with an objective to enhance denture retention and comfort during mastication have been developed since many decades. The present article describes piezography as a method to enhance retention, stability and function for the mandibular denture through a case report.

**Keywords:** Geriatrics, Piezography, Retention, Speech, Soft liner, Neutral zone, Stability.

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## INTRODUCTION

In the field of oral rehabilitation, particularly in geriatric prosthodontics, several sources may contribute to the performance of complete dentures. It is our general experience that lower denture is relatively less stable than the upper one. Increasing life expectancy, age-related reduction in adaptability and progressive severe mandibular resorption further worsens the condition. The situation demands a definitive and qualitative approach to overcome these difficulties. The most common errors might be attributed to insufficient tissue coverage, improper occlusion of the prosthesis, poor vertical and maxillomandibular relationships, incorrect tooth positioning and behavioral problems. One of the philosophies that was introduced to overcome the challenge of unstable denture in clinics was the concept of neutral zone.<sup>1</sup> The neutral zone concept was based on neuromuscular control on the polished surface of denture and positioning the teeth in space where the oral musculature and tongue forces are nullified by each other. However, the conventional as well as functional techniques have certain demerits. Therefore, Klein in 1974 introduced a method, named piezography, which recorded the prosthodontic space for teeth placement using speech.<sup>2</sup> In the following case presentation, we tried to implement

the piezographic technique in the fabrication of complete denture in a patient with long-standing edentulousness and severely resorbed mandibular ridge.

## REVIEW OF LITERATURE

Piezography in complete denture fabrication is a technique used to record shapes by means of pressure, a method of recording a patient's denture space in relation to oral function.<sup>2-4</sup> The term piezograph was coined by Klein in 1974 from the Greek term meaning 'a shape formed by pressure'.

Regarding complete denture treatment, several methods that take physiological function into account have been developed since the 1930s. These studies have clarified that the buccolingual tooth position and the contour of the polished surface are important for denture retention and stability.<sup>5,6</sup> Fahamy and Kharat reported that artificial teeth were arranged over the center of the alveolar ridges in conventional dentures, which was found to be better in mastication.<sup>7</sup> However, all the participants in their study experienced a superior sense of comfort and speech ability with the neutral zone denture and selected the latter over the conventional one.

The idea behind positioning artificial teeth in the neutral zone has two objectives. First, the teeth will not interfere with normal muscle function and secondly, the forces exerted by the musculature against the dentures will be more favorable for stability and retention.<sup>8</sup> Piezography helps to record the neutral zone. The denture fabricated based on piezography is more stable than the other conventional and functional techniques like swallowing.

Considering that a person swallows up to 2,400 times per day<sup>9</sup> and that during the entire swallowing sequence, teeth come into contact for less than a second,<sup>10</sup> it may be concluded that less than 40 minutes of tooth-to-tooth contact occurs per day during function. Since a person speaks much more than he involves in swallowing, we should follow phonation method more often to fabricate dentures for more stable denture prosthesis.

The buccolingual center of the occlusal table obtained by piezographic technique for fabrication of complete dentures is generally located slightly to the buccal of the residual alveolar ridge.<sup>11</sup> Morikawa et al (1983) reported that the centerline of the neutral zone was located 1.9 mm to the buccal side of the alveolar crest.<sup>12</sup> It is observed that

longer the period of edentulousness, the more buccally located the neutral zone was from the crest of the alveolar ridge.<sup>13</sup> The piezographic techniques employ silicon-based soft liners which are quite advantageous due to suitable viscoelastic property, ample working and setting time, ability to be injected gradually over several applications and easy to handle and work over patient.<sup>14</sup>

Although this technique can be used for all patients requiring a complete denture, there are specific situations where piezography helps fabricate a more stable and retentive prosthesis. Patients with long period of edentulousness, having a severely resorbed lower ridge are most benefited by this technique. Concave foundation of lower bones, compromised earlier denture and elderly patients are also good candidates for this method. Several advantages exist with this technique. As speech is employed for recording the denture space, the patients can practice before the impression is taken. The procedure is easy to understand, especially for the elderly. It is easy to inspect for proper oral function while the patients pronounce the phonemes and allows precise placement of artificial teeth.

## CASE REPORT

An elderly male patient aged 60 years, came to the Department of Prosthodontics, Guru Nanak Institute of Dental Sciences and Research, with the chief complaint of loss of all his teeth and inability to chew. On oral examination it was seen that the patient had a severely resorbed mandibular ridge, loss of vertical dimension, collapse of facial profile and loss of muscle tonicity. Lack of nutrition was evident due to inability to chew food properly. Conventional method was not considered and we decided to implement piezographic technique to manage the case.

Piezography is a technique used to record shapes by means of pressure for recording a patient's denture space in relation to oral function. It involves introduction of a moldable material into the mouth to allow unique shaping by various functional muscle forces. Speech is employed in the registration of the denture space by this technique.

The preliminary steps were performed following the standard procedures. Primary and final impressions were made for both the maxillary and mandibular ridges. Occlusal rims were fabricated. The upper rim was adjusted parallel to the Camper's line and 2 mm visibility was established.<sup>3</sup> The vertical dimension both at occlusion and at rest was recorded. A freeway space of 2 mm was maintained. The wax rim and cast assembly were mounted on a mean value articulator. The piezographic method was carried out from this position onwards. Since the technique was based on phonetics, the patient was made to practice pronouncing certain phonemes before it was actually implemented. The

speech exercise helped mold the material that was inserted in the mouth providing the prosthodontic space. The patient was asked to say 'SIS' four times followed by a strong 'TO' in order to obtain the posterior molding. Anterior piezography was obtained by asking the patient to pronounce T, D, M, P five times in a sequence clearly and vigorously. Once satisfied about the clarity of speech, we proceeded with the next step.

Next, the mandibular rim was removed from the cast and a stabilized base plate was fabricated from self-cure acrylic resin. Grooves were made on the external surface so that the moldable material can adhere to the acrylic (Fig. 1). A silicon-based self-polymerizing soft liner was used (Ufi Gel P, Voco Dental). Prior to placement of the base plate in the mouth, silicon adhesive was applied on top of the base plate for better adhesion. The maxillary rim was placed in the mouth. Upper anterior teeth were arranged so that it improved his speech during the pronunciation of phonemes (Fig. 2). Initially, the soft liner was first placed on the right side and the patient was instructed to pronounce the phonemes (Fig. 3). Once the material set, the piezographic record was checked and the same was done for the left side (Fig. 4). After the posterior dam was obtained, moldable material was placed anteriorly and the patient was asked to say 'TDMP'. The final dam was kept on the mandibular cast and inspected (Figs 5 and 6). Excess was removed with a knife and adjusted to the required height.

Analyzing piezography, it was noted that the lateral border of the tongue had created its impression on the dam. A similar observation was recorded for the apex of the tongue, which indicated its excursion and occupied space. Piezography of the vestibular part showed the muscular action of both the masseter and the buccinator muscles, which gave information about the available space for the posterior teeth arrangement and about the anterior teeth inclination.



Fig. 1: Retentive grooves on acrylic for the moldable material





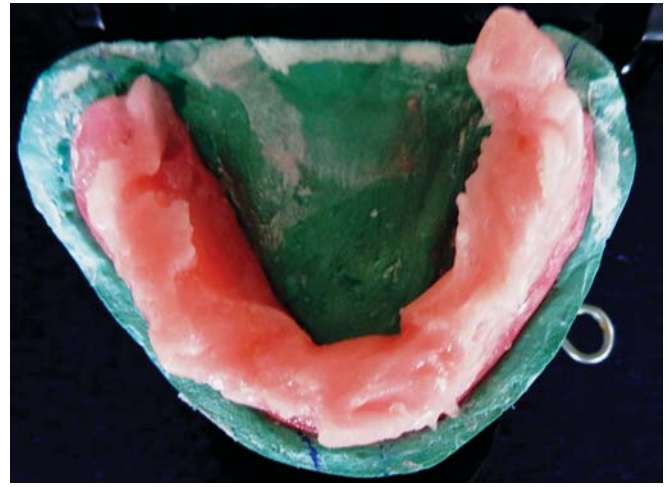
**Fig. 2:** Upper anterior teeth were arranged in a way that patient's phoneme pronunciation was improved



**Fig. 5:** Material molded anteriorly



**Fig. 3:** Soft liner added on the right side of the plate



**Fig. 6:** Final dam kept on the mandibular cast and excess removed with a knife



**Fig. 4:** Soft liner added on the left side of the plate

The exact neutral zone space was obtained with this method. The main objective being to convert this record into usable space for arranging teeth, a silicon index was fabricated over the mandibular cast. Grooves were placed

on the land area (two right and left side, one anteriorly) so that the index could be repositioned. Silicon putty material was mixed and index was made by adapting around the piezograph on outer and inner sides (Fig. 7).

After the dam was removed, the void was filled with molten wax to obtain a new wax rim (Fig. 8). The wax rim was adjusted to the predetermined vertical dimension and placed in the articulator. The posterior teeth were now arranged in the newly obtained space (Fig. 9). The waxed up teeth arrangement was tried in and esthetics and speech was adjusted and corrected. Dentures were finally fabricated and inserted after correcting processing errors (Fig. 10) Occlusion was satisfactory. Facial profile improved drastically (Fig. 11) and the denture was stable functionally.

## CONCLUSION

Piezographic method for complete mandibular denture construction provides the patient with a great degree of

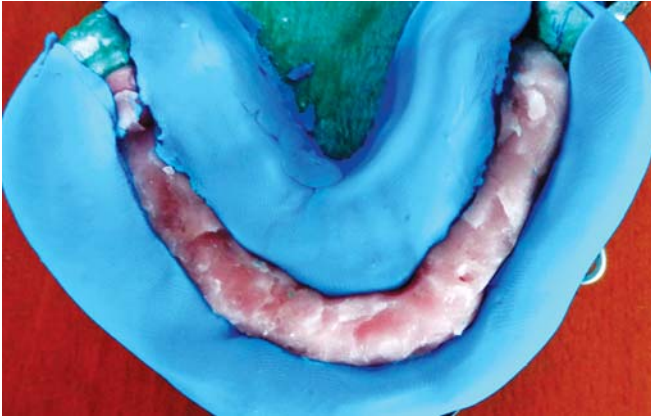


Fig. 7: Silicon putty index fabricated



Fig. 10: Final denture insertion done

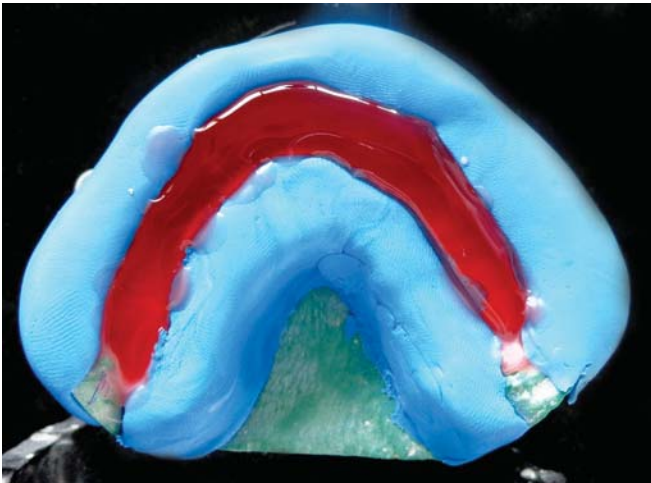


Fig. 8: Dam was removed and void was filled with molten wax to obtain a wax rim



Fig. 11: Patient's esthetics improved drastically



Fig. 9: Posterior teeth arranged according to newly obtained space

comfort and confidence. It results in creating favorable contours on the polished surfaces, especially for lower complete dentures. When bone resorption is significant, as generally noted in elderly patients, this technique allows for functional stability and facilitates adaptation to the new prosthesis.

Thus, it can be concluded that providing a lower denture with a piezographically produced lingual surface enhances its retentive ability over a conventional design. It seems reasonable to maximize the retentive potential with oblique sublingual polished surfaces and minimize the adaptive demand, particularly for older patients, by using a piezographic technique which not only 'customizes' contours and precludes overextension, but also helps arrange teeth for maximum comfort, function and esthetics.

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## ABOUT THE AUTHORS

### Jayanta Bhattacharyya (Corresponding Author)

Professor and Head, Department of Prosthodontics, Crown and Bridge  
Guru Nanak Institute of Dental Sciences and Research, Kolkata, West  
Bengal, India, e-mail: drjb68@gmail.com

### Preeti Goel

Senior Lecturer, Department of Prosthodontics, Crown and Bridge  
Guru Nanak Institute of Dental Science and Research, Kolkata, West  
Bengal, India

### Soumitra Ghosh

Reader, Department of Prosthodontics, Crown and Bridge, Guru Nanak  
Institute of Dental Sciences and Research, Kolkata, West Bengal, India

### Samiran Das

Professor, Department of Prosthodontics, Crown and Bridge, Guru  
Nanak Institute of Dental Sciences and Research, Kolkata, West  
Bengal, India