

A novel technique to fabricate occlusal surfaces for artificial resin teeth in base metal alloys

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ABSTRACT: *Statement of the Problem:* One of the existing problems in maintenance of balanced occlusion in complete denture prosthesis is the wear that is associated with artificial resin teeth. Wear of acrylic results in concomitant loss of vertical dimensions which later manifests in other problems like residual ridge resorption. Though there are at present certain brands which manufacture teeth with occlusal surfaces in metal, but they have not found much clinical acceptance by both dentists as well as patients.

Purpose: To fabricate occlusal surfaces of resin artificial teeth in base metal alloys in order to preserve the integrity of balanced occlusion in the complete denture prosthesis.

Materials and Methods: A completely edentulous patient, artificial prefabricated resin teeth, elastomeric impression material and pattern wax.

Results: Artificial resin teeth can be modified on the occlusal surface and transformation of occlusal surfaces in base metal alloy results in long term maintenance of occlusal contacts and thus maintains the principles of preservation of residual alveolar ridges.

Conclusion: Artificial resin teeth can be modified with this simple and novel technique of fabricating occlusal surfaces in base metal alloys.

KEYWORDS: Completely edentulous, complete denture prosthesis, balanced occlusion, adaptation, mastication.

INTRODUCTION

Modification of the body in one form or the other has attracted attention in humans whenever attempted since early times. Body modifications in the form of body piercing, tattooing, scar designing, elongation of the neck or narrowing of the waist have been attempted with success. Some have done it to look different, whereas some have done to fulfill their traditions while some have done to enter their name in the Guinness book of world records. The human organs that have been modified in one form or the other are nose, ear, eyelids, skin, nails and teeth. Modification of natural teeth has also been reported in the form of placing anterior gold crowns, bonded diamonds, tooth tattoo etc. These modifications in natural teeth are primarily done for nonfunctional purpose. These demands lie primarily in the zone of being less harmful to the patient and if oral hygiene is maintained properly then acceptance is assured. These body modifications have prompted the prosthodontist to innovate their prosthesis as well. Over the years artificial teeth have been modified to fulfill the objectives of an effective and versatile prosthesis. These modifications have included the use of materials like gold [1], [2], [3], acrylic resin [4], [5], [6] and porcelain [7], [8], [9], [10] as artificial substitutes for natural teeth.

Patients demand about the ability of their denture to masticate effectively is not new to any prosthodontist. Such demands are quite natural in the light of the many, varied activities which are centered in the oral cavity. It is even more understandable when one considers that mastication of food serves not only to meet the physiological limitations of swallowing but also to satisfy certain oral sensations. For a patient mastication with a denture without hesitating cultivates confidence in him for his prosthesis. The masticatory efficiency can be directly related to the overall efficiency of the selected teeth in the prosthesis. Factors related to denture that influence the masticatory performance of a denture have been studied. [11], [12], [13], [14] One of the important factors that has been found significant to masticatory efficiency is the food platform area. [15]. [16] There are many ways to increase the food platform area, [17], [18] one of which is the use of artificial teeth with steep cuspal inclines. One objective for every prosthodontist should be to maintain the food platform area throughout the life of the denture.

Among the various materials available for use as artificial teeth, resin teeth are diverse as they can be customized to the individual needs of the patient.[19] Even though the acrylic teeth do offer so many advantages they still have the drawback of not maintaining the food platform area because of wear of teeth. [4], [5] Rapid wear of artificial resin teeth leads to decreased masticatory efficiency and performance as well as problems associated with decreased vertical dimensions of the complete denture prosthesis. Acrylic teeth have been modified over the years to compensate partly for this problem. One such method is to customize the occlusal surface with gold alloy or base metal alloy. Due to the enormous increase in gold and gold related alloys it has become increasingly difficult for the common man to afford such treatment. This clinical case report describes a simple method to develop the posterior occlusal table of a complete denture in base metal alloy and a simple method to achieve balanced articulation for the same.

CLINICAL AND LABORATORY PROCEDURE

HISTORY - A male patient, aged 62 years came to the Department of Prosthodontics, Subharti University with a chief complaint of inability to chew properly with his old dentures which were fabricated one year back. The patient had been edentulous for the last 7 years and was wearing his fourth denture. Medical history was non contributory. Diet history revealed that the patient is vegetarian, but has the habit of taking betel nut along with tobacco (Dilbag pan masala) since last 20 years. The consumption ranged from 8 to 25 packets in a day. The existing denture that the patient was using was fabricated approximately one year back and the posterior teeth of the complete denture were severely worn off and stained (**Fig 1**). The patient's general, extra oral and intra oral examination revealed well formed existing maxillary and mandibular residual alveolar ridges. The patient also revealed that he had been advised to stop the habit but he was not able to do the same. His main concern was that due to the habit his all previous dentures became ineffective with time and desired a permanent solution. The patient also revealed that all his previous dentures were discarded because of the problem of wear. After evaluating the various prosthetic options, it was decided that a complete denture with modified anatomic (occlusal metal) teeth would be the prosthesis of choice.



Figure 1

CLINICAL PROCEDURES

Routine steps of denture fabrication were carried till jaw relations. Vertical dimension was deliberately kept towards the lower side (decreased) so as to minimize the stresses on the residual alveolar ridges. The artificial teeth were selected for

size, shape and color. Selection of posterior teeth had been already determined to be resin teeth with occlusal metal. The maxillary cast was mounted using a Hanau Widevue semi adjustable articulator (Waterpik, Ft Collins, CO, USA). The tentative centric was confirmed using an extra oral tracing device and the condylar guidance was determined by taking a protrusive interocclusal record (Take 1, Kerr, Romulus, MI, USA). The teeth were arranged after fabrication of modified artificial teeth.

FABRICATION OF MODIFIED ARTIFICIAL TEETH

Not much has been described about the various methods to modify occlusal surfaces. Modification of non-anatomic teeth however has been described. [20] The method described here is simple, practical and inexpensive. Customization of the occlusal surfaces of resin teeth was accomplished in the following steps:-

Step 1 – Appropriate size, shade and shape were first selected. These artificial posterior teeth were then attached individually to a plastic tab with sticky wax. Four indexes two for maxillary teeth and two for mandibular teeth were prepared using a combination of light body and putty elastomer (**Fig 2**). The putty index so obtained is to be used for fabrication of occlusal wax patterns. The putty index was examined for any discrepancy and within each impression a line was drawn from the maximum depth of each cusp. After necessary corrections molten inlay wax was poured into the molds upto a line that was drawn on the walls of the putty index. When the wax was still soft a modified bell pin was attached at two points within each wax pattern. A sprue was also attached to the undersurface of the wax patterns which would later be sprued to a sprue former (**Fig 3**). The attached wax patterns were later invested and cast in nickel chrome alloy (**Fig 4**). The castings of individual occlusal surfaces were retrieved and finished.

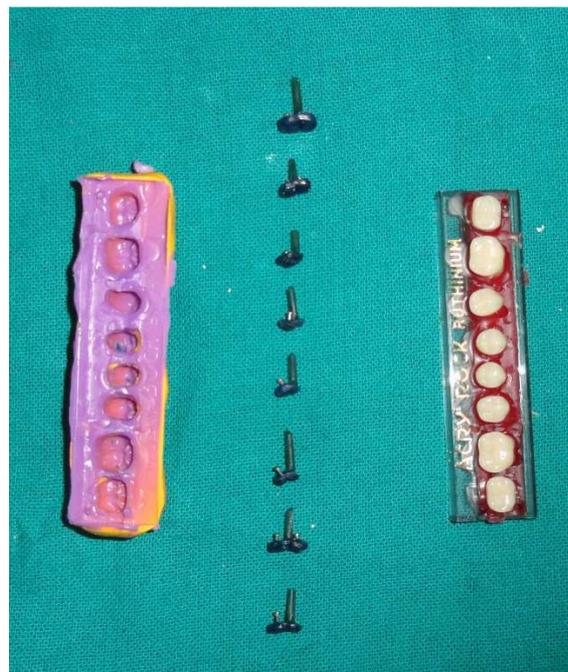


Figure 2



Figure 3



Figure 4

Step 2 – All the individual castings were now placed back in the same putty index from which their wax patterns were originally formed. After evaluation of their fit within the mold, tooth colored self-cure acrylic resin of the same shade as that of anterior teeth was mixed and poured into the putty index with the individual castings of modified teeth. The self cure acrylic resin was then allowed to polymerize (**Fig.5**). Any teeth that developed porosity of any sort were remade. The acrylic portion of the artificial modified teeth was then finished and polished with particular emphasis on the contour near the margins between the metal and acrylic.



Figure 5

Step 3 - All the modified posterior teeth were then arranged on the semi adjustable articulator (**Fig 6**). Individual teeth were arranged and were balanced individually against the opposing and adjacent teeth on the same side as well as contralateral side. Minor discrepancies on occlusal surfaces were removed only if the inclination of that individual tooth created esthetic imbalance.



Figure 6

Step 4 – After the approval of the trial dentures by the patient the dentures were processed, finished and polished (**Fig 7**). The denture was delivered to the patient after storing the dentures in water for 2 days (**Fig 8**). On the day of denture delivery a clinical remount procedure was carried out and necessary occlusal corrections were done so as to minimize occlusal interferences. The patient was put on a follow up protocol of 1 day, 1 week, 1 month and every six months.



Figure 7



Figure 8

DISCUSSION

Consumption of tobacco in one form or the other is widespread in north and east part of India (Dilbag pan masala). Addiction to these products is also widespread. Even elders who are above 65 yrs old consume the same due to the product being easily available and less economical. The main component of this pan masala is Areca nut. Areca catechu is the Areca palm or Areca nut palm, a species of palm, which grows in much of the tropical Pacific, Asia, and parts of east Africa. The palm is believed to have originated in either Malaysia or the Philippines. [20], [21]

The seed contains alkaloids such as arecaidine and arecoline, which, when chewed, are intoxicating and slightly addictive. The seed also contains condensed tannins (procyanidins) called arecatannins [22] and has been proven to be related to oral cancers. [23],[24],[25]

Dilbagh is a flavoured premium **Pan Masala**. **Dilbagh Pan Masala (DPM)** is a mixture of nuts, seeds, herbs, and spices and additives like limestone powder. The non-tobacco containing DPM is mainly served after meals in India. There are some modified versions of this pan masala that are also served in the Middle East and parts of Southeast Asia. In these places, they are served mainly as mouth fresheners. With the Indian population migration to other parts of the world, this product is available in most of the countries. Additives like limestone, lead to wear of the resin when used to wear complete dentures.

The putty index that was made should be examined for discrepancies. It is important to replicate the exact cuspal height and inclination of the artificial teeth if one is performing balancing articulation on a semi adjustable articulator. Light body

relining eliminates many such possibilities of error incorporation. In order to assure a uniform and adequate thickness of the occlusal wax patterns to accommodate finishing and polishing of the metal a line about 2 mm from the maximum depth of each cusp was put within each impression surface of the tooth index. This thickness also accommodates the modified bell pins that were placed on the poured wax so as to incorporate a mechanical lock with the resin that would be poured at a later stage. The modified bell pins were placed in the middle of the cusps where the thickness of the wax pattern was of maximum thickness.

Tooth colored self cure acrylic of appropriate and matching shade with that of anterior teeth should be poured in a fluid state rather than the acrylic dough. This allows the fluid resin to flow and engage the undercut of the head of the bell pins. Another difficulty that was encountered during resin bonding to occlusal metal was the effect of metal on the shade of the acrylic especially near the junction between the metal and acrylic. This can be overcome by either selecting a shade with lower value or adding the amount of acrylic near the junction. In this case the addition method was used and it masked the grayish tinge that was reflected in the resin. Care should be taken while trimming excess acrylic near the junction of metal with acrylic. Thin acrylic margins over the metal affect the shade of the tooth. The variety of shades that are available for self cure tooth colored acrylic resin are less, therefore it is possible that in some cases the shade discrepancy between anterior resin teeth and modified posterior teeth may arise. In such cases the occlusal surfaces of the artificial teeth should be modified.

Balanced articulation in such cases plays a very important role if one has to preserve the remaining residual alveolar ridge. The balancing of occlusion was carried in three stages. Firstly, at the time of arranging the teeth wherein balancing was achieved by incorporating compensatory curves. The balancing achieved during the arrangement of the teeth was further refined by proper laboratory remounting. The third stage involved a clinical remount balancing at the denture delivery appointment. During the last two stages refinement of occlusion was carried out by refining the metal occlusal surfaces of the completed denture.

SUMMARY AND CONCLUSION

Present day elastomer allows Prosthodontists with a wide array of improvising benefits. The above mentioned technique is simple, inexpensive, less time consuming and does not require much skill on the part of the prosthodontist. The technique also allows one to add tooth colored acrylic to the occlusal metal as many times as one wants without affecting the accuracy of the occlusal surface. The choice of balancing the occlusion before or after the teeth have been modified lies within the choice of the operator and should be balanced after considering patients expectations and needs. The technique is open for research and studies can be conducted regarding the bond strength of metal to self cure resin, various means of mechanical attachments or the quantitative errors during balancing.

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