

# Rugae Duplication – Different Techniques Of Customizing Palatal Rugae in Maxillary Complete Denture to Enhance Phonetics

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## ABSTRACT

**Speech** is imperative for human communication. Therefore, phonetics must be considered , along with mechanics and esthetics as the integral factors in contributing to the success of a dental prosthesis . Palatal rugae contours have a very important role in phonetics, by production of linguopalatal sounds that involves the contact between tongue and palate. By customizing palatal contours of a maxillary denture to the tongue, the patient may easily adapt to the definitive denture contour, which in turn shortens or eliminates the adjustment period for the achievement of proper speech. This review article deals with different methods of palatine rugae duplication in complete denture prosthesis to improve phonetics, besides briefly describing its role in various other fields such as sex determination, orthodontics and forensic odontology.

**KEY WORDS:** Palatine rugae, rugae duplication, phonetics, linguopalatal sounds, forensic odontology.

## INTRODUCTION:

Speech is an integral part of human communication, which makes the human species superior to other life forms. Although every prosthodontist aims at providing excellent complete denture prosthesis in terms of esthetics, functional efficiency and comfort, a thorough evaluation of phonetics is too often neglected with greater emphasis placed on other three components.<sup>1</sup>

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Among the various anatomical landmarks of the oral cavity, Palatine rugae are perhaps one of the least understood or unexplored regions of the oral mucous membrane. Due to this, they have been arbitrarily associated with functions like speech, adaptation, proprioception and taste.<sup>2</sup>

Palatal rugae also called plicae palatinae transversae and rugae palatina, refer to the ridges on the anterior part of the palatal mucosa, each side of the median palatal raphe and behind the incisive papilla.<sup>3,4</sup> Palatine rugae are elevations of the mucous membrane and are very prominent in most of the animals where they help in gripping the food before tearing it with brute force. Optimal phonetics can best be achieved by obtaining a proper occlusal vertical dimension (OVD) and occlusal plane, correctly positioning the anterior and posterior teeth to suit best the functional and esthetic requirements, as well as adequately contouring the palatal surface. Because the lack of texture on the palatal portion of a complete denture can impede proper articulation, one solution is to add palatal rugae.<sup>1,5</sup>

#### **CLASIFICATION OF RUGAE:**

Identification of palatal rugae pattern is based on classification by Thomas *et al.* This classification includes number, length, shape and identification pattern of rugae. By determining the length of all rugae, three categories are identified.<sup>6,7</sup>

1. Primary rugae (5-10 mm)
2. Secondary rugae (3-5 mm)
3. Fragmentary rugae (less than 3 mm).

The shape of individual rugae are classified into four major types

1. Straight – Runs directly from origin to termination
2. Curvy – Simple crescent shape that was curved gently
3. Circular – Definite, continuous ring formation, diameter from origin to termination is considered
4. Wavy – Serpentine form.

The unification pattern is further subdivided into diverging and converging types.<sup>8,9</sup>

Diverging pattern occurs when two rugae begin from the same origin but diverge transversely.<sup>10,11</sup>

Converging pattern occurs when two rugae arise from different regions and converge transversely.<sup>8,9</sup>

#### **METHODS OF RUGAE DUPLICATION:**

Characterization of the complete denture is necessary to give the dentures a life like appearance, to make it appear more natural.<sup>12</sup> Palatal rugae can be characterized and incorporated in the maxillary complete denture by different techniques.

#### **RUGAE DUPLICATION USING PUTTY IMPRESSION TECHNIQUE:**

The primary impression is made in impression compound using stock tray and cast is poured. Putty is adapted over rugae area of maxillary cast to record prominent rugae on the palate. Modelling wax is melted and poured over the putty impression slowly and carefully to record the imprints of rugae over the impression. Before flasking of denture, wax imprint of rugae was placed on maxillary trial denture base, adapted carefully on the palatal portion of the maxillary trial denture base.<sup>13</sup>



#### **RUGAE DUPLICATION USING DENTAL FLOSS:**

An ideal protocol for complete denture fabrication was followed till the stage of obtaining the secondary cast. Then, mark the rugae patterns in definitive maxillary cast using permanent marker. Apply auto-polymerizing resin (clear) in sprinkle on method on the rugae portion in the cast. The markings will be seen through the transparent resin in the cast. The thickness of resin added should not exceed 1 mm. Apply auto-polymerizing resin (pink) in sprinkle on method on the rest of cast and fabricate the record base in the usual manner. Proceed with the tentative jaw relation and teeth arrangement. Trial denture verification is done. Demount the maxillary cast from articulator. Cut dental floss as per the required lengths and lute them over the rugae marking seen through the record base using inlay casting wax. Proceed with fabrication of denture in conventional manner. The rugae pattern is duplicated in the denture.<sup>14</sup>



## RUGAE DUPLICATION USING TIN FOIL:

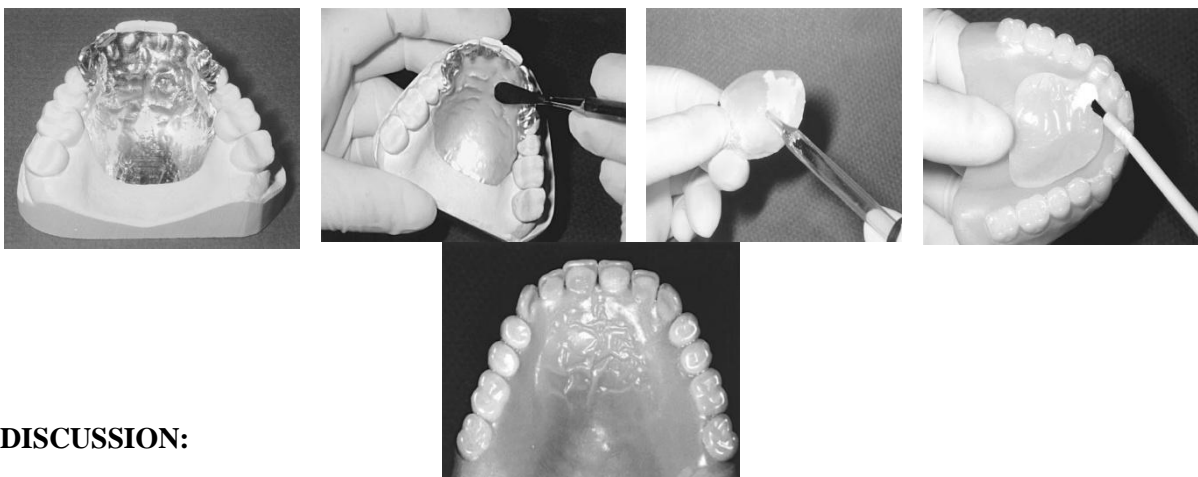
### NEW PROSTHESIS:

Cut tinfoil (0.001 tinfoil) to the desired shape and adapt it to the rugae area on the master cast with prominent rugae. Tinfoil pattern is removed from the cast and is sealed to the palatal area of the completed wax-up with hot baseplate wax. Then it is flaked, processed, finished, and polished as usual.<sup>15, 16</sup>



### EXISTING PROSTHESIS:

Adapt tinfoil on the cast with prominent rugae; flow hot baseplate wax over the surface to reinforce the tinfoil. Remove wax reinforced tinfoil from the cast and trim to desired shape. Autopolymerizing acrylic resin is applied on the underside of the tinfoil pattern to fabricate rugae. When cured, remove the tinfoil and secure acrylic rugae to the palatal area of the existing prosthesis with autopolymerizing acrylic resin. Refine, finish, and polish.<sup>15s</sup>



### DISCUSSION:

The procedure of electroplating to form metal palate that duplicates patients' palate is limited in that it does not apply to dentures made of acrylic resin.<sup>17</sup> Another procedure uses an impression of maxillary cast to make custom acrylic resin pattern to capture patient's anatomy. But this involves making additional impression or duplication of cast. Missing lingual contours of denture teeth should be added during waxing up of trial dentures in this method.<sup>18</sup> Use of palatogram and acrylic resin to modify palatal portion of denture has been done.<sup>19-21</sup>

The production of palatolingual group of sounds involves firm contact of the tip of the tongue against the rugae. When these rugae and the hard palate are covered by the denture, proprioceptive feedback may be changed. Therefore phonetics may be affected by the presence of denture. Copying of the rugae on the palatal surface of the denture reduces this problem.<sup>22,23</sup>

Accurate approximation of palatal contours of a maxillary complete denture to patient's tongue can improve intelligibility, if other factors such as tooth position, occlusal plane and vertical dimension are satisfactory.<sup>24</sup> A method for functionally modifying the contour of the palatal vault of maxillary complete denture can be achieved at the trial stage of denture construction and incorporated in the finished denture.<sup>25</sup>

Artificial duplication can be done using corrugated metal plates, plastic palate forms, free hand wax carving of anatomical palate forms etc. These artificial rugae may cause interference with speech if they are made too prominent.<sup>22</sup>

The use of ribbed features, when made from a significantly stiffer material and designed to mimic palatal rugae, offer an acceptable method of providing significant improvement in speech as well as rigidity to the maxillary denture.<sup>22</sup>

Besides phonetics the authors believe that they may play important role in biological adaptation of the tongue to the denture and important contributor in taste perception. Palatine rugae when duplicated on the denture improved patient's ability to identify flavors especially sour foods. Both responses as well as qualities of perception of sour taste improved with denture that was characterized with Palatine rugae. Understanding the perception of sour taste has received less attention than sweetness and bitterness, particularly for mammals.<sup>16</sup> Multiple mechanisms have been proposed to explain how hydrogen ions interact with taste receptor cells to cause a response.<sup>22,23</sup> Although it has been widely accepted that the hydrogen ion is the chemical entity responsible for the sour taste, many physiological studies have indicated the involvement of protonated organic acids as a

stimulus for sour taste as well. Irrespective of the mechanism for the sour taste of tongue, the patient was able to perceive the sour taste soon as well as better. The denture with palatine rugae provides an irregular surface against which the tongue is locked appropriately than with the flat surface. Once the tongue is locked in place a negative pressure is developed by it so that the flavor from the foodstuff is sucked. This is especially true for the sour taste. Another reason for better perception would be that when the tongue touches irregular surface of the palatine rugae, the elevations and depressions on the denture open up the microvilli by stretching them away from each other. This allows the hydrogen ion from food to come in contact with the taste receptor cells that are oriented perpendicular to the surface in a parallel arrangement.<sup>2</sup>

### CONCLUSION:

Phonetics is one of the important factors in complete denture construction. However, this factor is neglected because of the adaptability of patients. It is true that most patients can learn to produce satisfactory speech in spite of an unsatisfactory denture. The need to consider phonetics is not recognized in most instances until a patient complains of inability to produce certain sounds with the dentures. Completely edentulous individuals using dental prosthesis tend to mispronounce certain sounds, pronunciation of which depends upon the rugae pattern and also the palatal contour. Thus, prosthodontists need to create the customized rugae and palatal contours in complete dentures with care for achieving speech which is much more normal and also eliminate the waiting and training period after denture insertion. To aid the dentist in minimizing these speech problems, the importance of phonetics in dental prosthesis has been discussed.

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